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The Institute of British Foundrymen
The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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Foundry Costing

We, in common with the rest of the foundry industry, are looking forward with a good deal of interest to the publication in the near future of the preliminary Report of the Sub-Committee on Costing which is to be presented at various centres during the autumn by the Convener and other members of the sub-committee of the Institute of British Foundrymen. As far as we have been able to interpret public opinion on the subject, controversy centres around two main subjects. The first is the apportionment of overheads, and the method of dealing with domestic scrap in the ascertaining of melting costs. We have encountered at least three methods of absorbing overheads in various foundries. In many cases it is related to direct labour expressed as hours, in others to the weight of the castings, whilst a third takes as the basis the amount of floor space and the period of occupation by the moulds. There is a basic fault with all these systems from the practical point of view, as each system either favours or penalises some type of casting made as related to true worth or market value. If castings made from loose patterns have to help to pay the depreciatory upkeep and repair on moulding machinery and auxiliary plant then machine-made moulds are receiving an advantage in market price to which they are theoretically not entitled. On the other hand, if the machine-made castings are having to carry overheads on the parts of the foundry devoted to making castings from loose patterns they too may be penalised because the rate of output is low, whilst supervision, general office staff, rent, rates and taxes, heating and lighting costs are high when related to value of the castings made on each unit of floor space.

Some experts wish to assess the apportionment of overhead costs to types or a certain location, but we adhere to the notion that each individual casting must be costed by itself, but more factors than merely weight of metal and time of moulding must be taken into consideration. If the mould is to be machine-made then money must be added for its use. Instead of writing off a machine in five or ten years, it seems better to say that its cost must be recovered in 100,000 or 200,000 moulds, depending on the type. Thus, with charges added for upkeep and power costs, it becomes strictly comparable with loose-pattern moulding so far as the apportioning of overheads are concerned. For a mechanised foundry something similar can easily be evolved, yet still related to the cost of making a mould.

The method of taking care of domestic scrap has been the subject of much controversy in these columns, and a judicial summing-up would be that where one type of casting was made it can be ignored by lumping up all the raw materials bought during the year and dividing the total by the weight of good castings made, but where every casting has to be individually costed then the jury has been unable to agree.

Conditions in Germany

We referred recently in our columns to the report by the British Commercial Counsellor at Berlin on German economic conditions. The remarkable political changes which have taken place in that country and which have furnished the daily Press with headlines for weeks on end, have tended to obscure the industrial changes which the political developments have brought about. These are very important, for in any world trade recovery Germany is bound to re-assert herself as a competitor of this country, especially in the foundry trade. She possesses all the resources required in raw materials and an enviable degree of metallurgical skill and practical experience.

In Germany to-day laws are imposed by the Government entirely without discussion. The combined scheme for organisation and control has very seriously limited the liberty of action of the business man. For example, work for the unemployed has been provided by a variety of schemes, not only initiated by the Government, but also by industry and individuals acting under the persuasion and with the aid of the Government. By inducing employers to take on more men than they require and wage-earners to accept lower wages the tendency is to share the available income with the rest of the nation, on the slogan "public good comes before private profit." This is bound to have an influence on commercial costs and prices, and hence generally on the competitive position. The huge unemployed total in 1933 had been reduced by February, 1934, to two and a-half millions. All available resources were set in motion to stimulate buying and consumption. The maximum employment of labour was ensured by shortening of hours, refusal to permit dismissals and insistence on employment of extra hands, even if not necessary. The difficulties of the country with respect to the exchange and the import of raw materials are well known. Whether the industrial machine can be run at high pressure without an external outlet for its products remains to be seen, but difficult as has been the past few years to the British employer, the inconveniences pale into insignificance before those the German employer has had to suffer.

XUM

Nervousness in Tin

BY "ONLOOKER."

Tin has been the subject of manipulation for so long that one really does not know where reality leaves off and pretence begins. The strings are, of course, being pulled by the International Tin Committee, which having obtained a mandate from the countries concerned has been busy for months past manœuvring matters so that a price well in excess of £200 per ton has become inevitable. There was a time not so very long ago when it looked very much as if values would climb up to £300, but quotas were increased to stave off a condition of famine, and soon after that consumption began to fall away in a very disconcerting fashion.

Now another change of front has become necessary, for the recent improvement in the rate of American consumption is not expected to last, and with the prospect of a definitely lower rate of use to worry them the Committee has announced a reduction in the export quota from 50 to 40 per cent., this alteration to come into force from October 1 next. This will bring the situation back to where it was six months earlier, viz., April 1, and, judging by the July statistics, it looks as if by the time the change is made there will have been quite an appreciable increase in visible supplies. Consumers will not quarrel with that, for what with an unduly inflated price and falling stocks the position from their point of view has not been by any means a happy one for many a long day.

Reference is made above to an improvement in American consumption, but perhaps it would have been more correct to say that buying in the States has recently been on a better scale. Undoubtedly some of this is speculative in character, for with a revival of inflationist talk many people have made up their minds to put money into commodities before a rise in values takes place. This metal will, of course, be heard of again, for an investment of this kind is of a temporary nature and speculators will not hold on after they can make sure of a reasonable profit on their holding. In connection with possible inflation in the States, it must, of course, be remembered that tin prices are "made" in London, and that even the Eastern market, although it has its influence on Whittington Avenue, is not the final verdict by any means.

What is troubling most people in tin to-day is the fact that strenuous efforts are being made to employ substitutes, and without any doubt these attempts are being rewarded with a considerable measure of success. With the price above £200 this search for substitutes is going to continue, and in the long run it cannot fail to have an effect upon the demand for tin. It is true that canning is not the only trade absorbing tin, but it does account for a very considerable tonnage every year, and without the demand created by the manufacture of tinplates, tin would be, so to speak, "nowhere." Small wonder then that intelligent and longsighted people are disturbed at the persistent search for substitutes which is going on, for they realise only too well, with events in copper to guide them, the dangers of holding a commodity at too high a level. Eventually the quotation has to come down, but by then the damage has been done, and users have transferred their affections elsewhere. Whatever the Tin Committee may think about it, tin is not worth £230 to-day, and the maintenance of that level will lead to trouble.

AT THE INSTANCE of Messrs. John Brown & Company, Limited, debenture holders, a receiver and manager has been appointed for Messrs. Davy Bros., Limited. Efforts are being made to bring about a financial reconstruction of this firm, whose world-wide reputation for iron- and steel-works plant is sufficient to offer good prospects if the present financial difficulties can be overcome.

District Presidents.—No. I

LONDON BRANCH OF THE INSTITUTE OF BRITISH FOUNDRYMEN

Mr. A. S. Beech, the new President of the London Branch of the Institute of British Foundrymen, is managing director of Messrs. Foundry Equipment, Limited, and one of the most prominent personalities in the foundry industry. After serving an apprenticeship with Messrs. Richard Johnson, Clapham & Morris, Limited, of Newton Heath, Manchester, he left them to join H.M. Forces in 1914, and was invalided out in 1915. He was then appointed

MR. A. S. BEECH.

assistant foundry manager at the Westland Foundry of Petters, Limited, at Yeovil, Somersetshire. In 1919 he was appointed director of the Universal System of Machine Moulding & Machinery, Limited, and in 1932 he became managing director of Messrs. Foundry Equipment, Limited. Mr. Beech was a founder of the Foundry Trades Equipment & Supply Association, of which he was President in 1930. He has lectured before many of the branches of the Institute of British Foundrymen.

CHROMIUM UP TO 0.50 per cent. is now being used commercially in malleable castings in America. Chromium increases the tensile strength and has no adverse effect on the annealing properties.

Wear of Metals

In the study by the U.S. Bureau of Standards of the effect of surface oxide films on the metal-to-metal wear of steels, it has been found that hardened-and-tempered plain carbon steels, tested in a hydrogen atmosphere on the Amsler wear machine, showed rather abrupt transitions from one condition of wear which is characteristic of low tempering temperatures to a distinctly different condition of wear characteristic of higher tempering temperatures. The wearing of specimens tempered at the lower temperatures was accompanied by the formation of surface films, and the rate of wearing was relatively low; on the other hand, the wearing of specimens tempered at the higher temperatures resulted in a very bright, rough surface, and the rate of wear is relatively very high. Tests recently completed have shown that the tempering temperature which corresponds with this change in type of wear increased with increasing carbon content of the steel. It was close to 200 deg. C. in a 0.4 per cent. C steel, about 300 deg. C. in a 0.8 per cent. C steel, and between 400 and 500 deg. C. in a 1.3 per cent. C steel.

Report of Special A.S.T.M. Sub-Committee on Test-Bars

BY R. S. MACPHERRAN.

The Special Sub-Committee on Test-Bars appointed by Committee A-3 on Cast Iron of the American Society for Testing Materials was requested to secure information as follows:—(1) Methods of making test-bars. (2) Correlation of test-bar sizes and controlling sections as shown in the Tentative Specifications for Grey-Iron Castings (A 48-32 T).[1] (3) Determination of deflection values in the transverse tests. (4) Comparison of tensile-strength tests on broken halves of transverse test-bars and on separately-cast tension bars.

Information on the above is necessary in order to provide a check on the provisions of the Tentative Specifications A 48-32 T, so that these specifications may be revised and made of greater value.

Some work was done on methods of making test-bars, including bars cast horizontally in green sand and on bars cast vertically in dry-sand cores. However, a good deal of the work planned was not completed in time for this year's report and, consequently, definite recommendations on the manufacture of test-bars cannot be made at this time.

The strength of any iron is affected by the cooling rate. The total weight and the various cross-sections of any casting will affect this cooling rate. For example, a plate or section 1 in. in thickness will cool more slowly in a 10-ton casting than in a 100-lb. casting. This may also be modified by the fact that in a casting with largely a 1-in. section, there may be other sections of much greater thickness which will retard the cooling rate. This fact should be recognised and taken into consideration when translating the strength of a test-bar into the strength of a section of a casting.

A test-bar cools from all sides, whereas a plate cools from two sides only. Schwartz and Vath[2] report that up to a wall thickness of 30 mm. (1.18 in.) a plate is properly represented by a round test-bar whose diameter is equal to twice the thickness of the plate. These results, together with the results of the investigations of this special committee, indicate that it will be necessary to revise the thickness of sections to be represented by test-bars, as shown at present in Specifications A 48-32 T. The report concludes with tables of tests carried out at various American universities and at the Allis-Chalmers Manufacturing Company.

THE AMERICAN NON-FERROUS FOUNDRY ASSOCIATION for Industrial Recovery will hold its annual meeting at the Hotel Bismark, Chicago, on September 19 and 20.

Decomposition of Cementite in Cast Iron

To study the time-decomposition function of cementite in cast iron, E. H. KLEIN, according to a Paper in "Stahl und Eisen," took cast-iron samples in which the graphite was partly finely divided and partly in coarse lamellæ owing to superheating of the melts and pre-heating the moulds, and heated these in nitrogen to temperatures between 550 and 700 deg., during which the linear expansion and cementite-decomposition were studied with respect to time. It was found that elongation was directly proportional to the rate of decomposition, which latter may be represented by a chemical reaction of the first order. A certain lag precedes the initiation of this reaction, and is assumed to be due to graphitic nuclear action, the graphite at the beginning being enclosed by a ferrite film which must first be bridged by diffusion. The nuclear action also explains the more rapid decomposition of ferrite in samples containing finely divided graphite as compared with those containing coarse graphite grains. The velocity of decomposition of cementite increases with the temperature according to the logarithmic expression deduced by Arrhenius.

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1 Proceedings, Am. Soc. Testings Mats., vol. 32, Part I, p. 625 (1932); also 1933 Book of A.S.T.M. Tentative Standards, p. 145.
2 FOUNDRY TRADE JOURNAL, October, 12, 1933.

Foundry Selling Practice

NEW SALESMEN FOR OLD

By Eric N. Simons

Old soldiers are said never to die; but old salesmen do, and the foundry sales manager is called upon—perhaps not more than once or twice in his own lifetime—to replace them. This is always a difficult problem, some aspects of which have been touched upon in past articles. The point concentrated upon here is, however, the vexed question of whether the new man shall be chosen from the foundry fold or whether he shall be an outside man with a ready-made connection.

Now it would be stupid to argue that there is a definite answer to this question that will fit any and every foundry under the sun. In the first place, a great deal, if not everything, depends on existing circumstances. The foundry itself, if of medium size, may not have a staff large enough to supply a constant stream of likeable young engineers capable of going out on to the road, and may, willy-nilly, have to rely on outsiders, or on the efforts of its own heads, who may be their own order-getters. On the other hand, it may be so vast, so complexly organised, that it has no personality of its own, and fails to awaken in the minds of its young men that feeling of intense personal loyalty that is one of the finest assets of the young home-trained salesman.

But, assuming, for the purposes of this argument, that the firm is one with a reputation for fair treatment of its employees, that its heads are not too remote from the personnel for the latter to feel a certain respect for and attachment to them as individuals, that its aim throughout its existence has been to foster a spirit of corporate effort among its men, then it is fair to say that, all things being equal, the home-trained salesman will prove a better investment when a job falls vacant than the brilliant outsider. It will be as well to examine the reasons for this statement. (It is assumed, of course, that the young salesman has been definitely trained for salesmanship, *i.e.*, not picked out of a job and sent on to "the road" without at least a preliminary period in and about the works.)

Now the first asset a young man of this type possesses, which the best possible outsider cannot have, is precisely that feeling of personal loyalty, of gratitude for having been given his chance, that will spur him on to put forth his very best efforts to show—if he is of the right type—that he is worthy of the confidence placed in him. Secondly, he will have the enthusiasm which is the special characteristic of the young man with a career to make. Let it not be denied that this very enthusiasm will at times lead him to make mistakes, but he is young enough to learn from his mistakes.

The Advantages of Popularity

Thirdly, he has the great advantage of knowing the people at the foundry itself, and, again, if he be of the right type, of being popular with them. Presumably, it is his good-fellowship and popularity with all and sundry that, combined with his technical training, have singled him out as a suitable representative. He takes with him good wishes and goodwill. He has the liking of the very people who, later on, may make or mar his activities.

What does this mean in hard fact? It means that, when a customer places a rush order, this young man will be able to write a personal note to Brown of the moulding shop, and say: "Bill, old fellow, there's a chance of real good business if we can give this firm the delivery they want. Will you do your best for me?" And because he knows and likes young Smith, Bill *will*. Or it may be that a customer complains of a piece of carelessness. Instead of writing a nasty letter to his firm, Smith smoothes the customer down, and drops a private personal note to Jones: "You've made rather a bloomer over this job, old boy, but I've smoothed them down, and there'll be nothing said; but do see that your fellows don't make the same mistake again, there's a good fellow!" Jones realises that he has been saved from a serious reproof, and is grateful.

The outsider, however, not knowing so intimately all the persons involved, would have no option but to write formally to his employer, and his letter would filter through the usual channels, accompanied by directorial or other criticisms, with the result that, even if Jones or Brown felt guilty, they would not feel love for the representative whose report had caused their chastisement.

The next asset the young home-trained man has at his disposal is precisely that which, to many foundry proprietors, suggests itself as a disadvantage. This is his inexperience. Inexperience can, of course, lead to blunders; but it does other things. It leads to discoveries. Way back in 1890, old Harper, perhaps, found that Blankshire was not worth while visiting, as there were but few potential customers, so he discontinued his calls. The inexperienced Smith, however, includes Blankshire, discovers it has become an industrialised county, and makes several new customers. Or, alternatively, old Harper may have learned by experience that it is impossible to sell gunmetal castings to Waley's of Muggleton, but the innocent and inexperienced Smith calls on Waley's, and, in ignorance, tries to sell them gunmetal castings, and, moreover, succeeds, as in the interim Waley's have discovered a use for gunmetal castings; or the buyer likes young Smith better than his predecessor.

Experience may have taught old Harper that it did not pay him to sell stainless-steel castings. The customers are too few and the commission too small. The inexperienced Smith, however, creates new customers for stainless castings, and finds the commission on the bulk quite useful.

But it will be argued that all this takes time, and meanwhile the orders that it requires an old and experienced hand with a personal pull to obtain are going past the foundry. Is this true? It is granted that young Smith has no personal connection, all ready-made, to bring to the business. But has not the firm its own connection? Has it been trading all these years for its reputation to mean absolutely nothing, and the representative to mean everything? If so, then it has been badly managed. Is it true that, when Robinson leaves X & Company, his customers automatically follow him? The probability is that not 20 per cent. place their orders with his new firm until he has shown clearly that he can give them something better than they had before, and that takes often as long as it takes Smith to get himself appreciated by his customers. Of course, Robinson is known and knows the district; but, taking it all in all, it will be found, on analysis, that every salesman of genuine personality probably makes one antagonist for every two friends. This is inevitable. No man with genuine ability can be popular with everybody he calls upon and the rejectors of Robinson go with him as well as his acceptors.

Furthermore, the ready-made salesman, even granting that his connection is a valuable one, has no ties of sentiment to hold him to his new firm. While he may be everything that is honourable, there is no reason why he should turn down a better offer from one of his firm's competitors, if it is made to him, and take his connection away from them as freely as he has bestowed it upon them. The home-trained man, however, will feel a certain attachment that will often outweigh a seeming personal advantage. He feels in his heart that his chance came from his employers, and often enough he will not even entertain other offers, if they have treated him fairly all through. Furthermore, he considers himself a part of the foundry, essentially one with it; if a customer attacks the firm in his hearing, he feels it as a personal affront, and defends it enthusiastically. The outsider is inevitably more philosophic, and prepared to concede that his firm is not perfect. It need scarcely be said which attitude is the more likely to win the customer and keep him.

Again, young Smith is probably known to and knows the other foundry representatives. This is an advantage when questions of territorial or other rearrangements come into question. He is not, to them, a man from outside, presumably out for his own interests alone, but one of the firm, a member of the fraternity, so to speak, and it can be taken for granted that the clannish spirit which makes a man prefer one of his own colleagues to the most courteous and polite of "outsiders" operates just as effectively in foundries as in other bodies. They will give Smith hints; help him with letters of introduction; put him on to good prospects. The experienced outsider they will probably regard as quite capable of looking after himself.

Hence, all things being equal, it is better to promote the young man from inside when a salesman's position is to be filled than to engage the ready-made article.

Blast-Furnace and Ammonia Manufacture

B. M. Suslov, of the Research Institute, Grosnest Trust, U.S.S.R., in the course of an article in a recent issue of "The Iron Age," points out that the Soviet Nitrogen Institute, in the interest of making synthetic ammonia, has conducted experiments by which the iron blast furnace is made a producer of gas suitable for the synthetic process. The pig-iron, states the article, becomes virtually a secondary product. A cold blast containing 55 to 60 per cent. oxygen is proposed for the process on a large scale. No hot-blast stoves are therefore required.

German Steel Trust

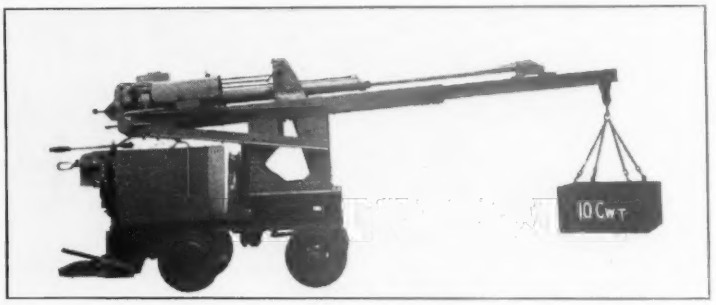
The first financial report to March 31, 1934, of the reorganised Vereinigte Stahlwerke A.-G. (German Steel Trust), which has a capital of £27,500,000 at par, has been issued. It is difficult to make a comparison with the returns of previous years owing to the extensive reorganisation and decentralisation which took place last year, and since the last complete report was for the financial year 1930-31. The present report compares outputs and charges in the March quarters of last year and this year; coal output increased from 3,808,000 metric tons to 4,442,000 tons, and steel production from 605,753 tons to 975,755 tons, while employment advanced from 116,150 to 131,654 persons. Salaries and wages accounted for 52,585,000 Rmk. in the March quarter of last year and 67,989,000 Rmk. in the corresponding quarter this year. There was also a marked increase in taxes and social contributions from a total of 8,869,000 Rmk. to 10,942,000 Rmk. During the year under review a number of idle works were restarted and there was a marked improvement in home sales; in spite of exchange difficulties there has also been a large expansion in the coal and iron and steel export trade. To conform with associated concerns, the new trust will in future start the financial year from October 1. The year 1933-34 closed with a profit of 8,580,000 Rmk., to which is added the previous year's profit of 6,290,000 Rmk. of the old Gelsenkirchener Bergwerks A.-G., the total of 14,870,000 Rmk. being carried forward.

XUM

The Electricar "Stowaway" Crane Truck

An outstanding development in mobile cranes has been designed and manufactured by Electricars, Limited, of Lawley Street, Birmingham, for carrying and stowing or stacking goods in restricted places in factories, foundries, warehouses, docks, ships, and the like. It may also be used for loading covered railway and similar wagons, a purpose for which it was originally constructed.

One notable feature is the replacement of the usual cables and chains by hydraulic-ram operation, which, it is claimed, reduces risk of failure and ensures greater safety. The jib consists of steel channels mounted on a pivot bar arranged on extending arms of a steel angle framework pedestal. The jib moves from a position just below the horizontal to an angle of about 35 deg. An inner channel section of the jib is extensible, and a hook carried by this inner section may be raised from 1 ft. 6 in. from ground to 10 ft. 6 in. The extending jib gives a travel of the hook from 3 ft. in front of undercarriage to 7 ft.



THE ELECTRICAR "STOWAWAY" CRANE TRUCK.

The jib and pedestal are mounted on ball bearings to the undercarriage for slewing by hand, the hook moving to 2 ft. 6 in. from either side of the centre line at the lowest position, and 1 ft. each side at the extreme raised position, ensuring stability with full load at all positions. This reduction in movement as the hook is raised is controlled by a roller on the jib pedestal engaging a tapering arch of the steel channel, the roller being raised as the jib elevates. The arch is situated on the undercarriage to the rear of the pedestal.

The undercarriage is of the usual industrial truck type mounted on two axles, both of which are fitted with steering wheels. The wheels have solid rubber-band tyres and are mounted on ball or roller bearings. The rear axle is of the overhead worm-drive type, with bevel differential, and having differential shafts with ball and claw universal joints to transmit drive to road wheels on all degrees of lock. A totally-enclosed series traction motor of 2½ h.p., 30 volts, traverses the crane through a chain-type flexible coupling to the axle worm. At the rear of the undercarriage is the driver's platform, and a steel dashboard carries the drum controller which gives three speeds in both forward and reverse directions, an ampere-hour meter, and the main switch. The steering tiller is also arranged at this end.

The main switch is operated by a "deadman" pedal, which is also connected to the brake arranged on the traversing motor armature shaft. Releasing the pedal opens the power circuit and allows the brake to be applied by spring pressure.

The main battery is fitted in a steel housing on the undercarriage frame to the rear of the pedestal. The housing is made to accommodate 16 lead cells or 24 nickel cells, of 300 amp.-hr. capacity, which gives a range of about 11 miles per charge with a full load. On the jib is arranged a 1½-h.p., 30-volt motor driving an Electricar rotary high-pressure oil pump, through a fabric flexible coupling. The pump delivers oil to two rams. One is fitted vertically under approximately the centre of the jib, and in extending under oil pressure raises the jib. The other is mounted horizontally along the jib and moves the extending portions of the jib and hook.

The rotary sleeve valves are arranged in hydraulic circuit with ports to feed either ram as required, and pass the return oil to feed the tank. These valves are operated by a joy-stick lever arranged close to driver, which is moved in the direction of the motion required for load, one lever controlling elevating, extending and return. Cams are fitted to valve levers which close a drum-type switch for the pump motor when the respective valves are open to the rams. At the extreme position of the motion of the jib in elevating and extending, stops are fitted to cut off the oil supply and open the motor switch to prevent overrunning.

Rumanian Iron and Steel Industry

Important changes have taken place in recent months in the Rumanian iron and steel industry. The Compagnie Europeenne de Participations Industriels (C.E.P.I.), recently formed at Monaco, and in which Vickers and the Prudential Assurance Company are participants, as well as a Rumanian group under the lead of the Titan-Nadrag-Calan concern, have acquired controlling interests in the Rumanian, Polish and Jugoslav iron and steel industries. This step brings the Rumanian iron and steel works in closer touch with other Slav steelworks, and is the more important since the Rumanian industry is undergoing rapid expansion. Employment in the industry has grown apace and prices reduced in closer comparison with world levels. The home market is protected by high tariffs which practically exclude foreign products and thus favour the development of the steel industry. One serious source of complaint of the industry is the high taxes imposed on it and which in 1931 and 1932 represented roughly 50 per cent. of the total revenue of the Rumanian budget. The expansion of the industry is shown by the figures for recent months. In January to April inclusive, pig-iron output was 35 per cent. higher this year than in 1933, while prices have declined by 7 to 8 per cent. The supply of sufficient iron ore is still a difficult problem, as import licences are only given for a barter trade and exporters demand and get up to 30 per cent. premiums. In January two extra furnaces were put into blast, and a third this month, the demand for pig-iron having steadily increased. A further furnace may shortly be relighted at the Hunedoara State ironworks. Steel output is also increasing, and the Reschitza works estimate that output this year will reach 150,000 tons as against 110,000 tons last year. The Titan-Nadrag-Calan estimates an output of 65,000 tons this year. According to the recently-issued financial reports, the Reschitza Ironworks made a gross profit of 402,250,000 lei (£500,000 at par) last year, as compared with 368,090,000 lei (£450,000 at par) in 1932, and net profits of 43,550,000 lei (£53,500) and 29,810,000 lei (£36,700) respectively. The Titan-Nadrag-Calan concern made a net profit of 52,800,000 lei (£65,000) in 1933 as against 48,900,000 lei (£60,000) in 1932.

A Stopper for Pressure-Testing Castings

Certain castings, writes Mr. G. Mouillebouche in the current issue of "La Revue de Fonderie Moderne," such as cylinders, pump bodies, air vessels and the like, have to be tested under water pressure to reveal possible porosity in the metal. In order to seal vent holes, the author for some time past has made use of the stopper illustrated in Fig. 1, which has given extremely good results. It is made up of (1) an india-rubber sleeve, A, of a slightly less diameter than the hole to be sealed; (2) a machine-made screw, B, mushroomed at its end and carrying a rotatable washer, C, of a diameter slightly less than that of the sleeve, and (3) a nut, D, and a washer, E. Its operation is extremely simple. The stopper is placed on the hole to be sealed and a few turns are given to the nut. The sleeve is thus compressed between the two washers and presses tightly upon the walls of the hole. The assembly and dismantling of this stopper is very rapid and allows castings to be tested before machining and consequently eliminates the operations of tapping and sealing, which had to be done on all castings before testing. For the water inlet, the author has used a similar stopper, but the screw, B, is hollow and carries on its upper portion a connection for the india-rubber tube leading to the testing pump.

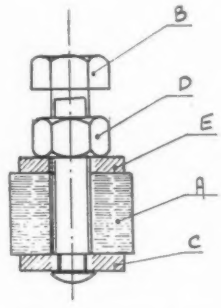


FIG. 1.—SEALING DEVICE FOR WATER-PRESSURE TESTING CASTINGS.

Iron and Steel Output in July

The British Iron and Steel Federation reports that there were 99 furnaces in blast at the end of July, compared with 100 at the beginning of the month, one furnace having ceased operations. Production of pig-iron in July amounted to 527,200 tons, compared with 514,900 tons in June and 343,900 tons in July, 1933. The production includes 133,200 tons of hematite, 259,100 of basic, 112,200 tons of foundry and 8,700 tons of forge pig-iron. The output of steel ingots and castings amounted to 718,200 tons, compared with 757,500 tons in June and 567,500 tons in July, 1933, the decline in production being due to holidays in Scotland.

High-Temperature Metallographic Microscope

Several years ago an apparatus was developed at Harvard University by Dr. B. A. Rogers, which permitted the direct observation of the microstructure of iron at high temperatures, even up to the melting point of the metal. This apparatus is now being applied at the U.S. Bureau of Standards to the study of the austenitic grain size in carbon tool steel. While it is possible to maintain a bright, clean surface on a specimen of pure iron in this high-temperature metallographic microscope by passing hydrogen through the enclosed specimen chamber, hydrogen must not be used when the specimen under examination is carbon tool steel because of the rapid loss of carbon caused by the hydrogen. The examination of the carbon steels is being carried out in an atmosphere of mixed CO and CO_2 and in an atmosphere of helium.

Some Factors Influencing the Density and Soundness of Ferrous and Non-Ferrous Castings

By E. Longden (Foundry Manager, Craven Bros. (Manchester), Limited)

(*Concluded from page* 88.)

Examples of Mould and Gas Inclusions and Apparent Liquid Shrinkage

Fig. 1 is a photograph of a 3½-cwt. cast-iron blank for turret heads used in boring and turning mill machine tools. Such castings, to the outside observer, appear simple to make, but they present problems of unusual character. As will be noted, a sand core 2⅝ in. dia. passes through the centre of the blank, and is machined to 3¼ in. dia. Holes are drilled and bored from various points and angles, and the casting is machined all over. When cast in the most suitable metal, it is practically impossible to avoid considerable porosity and distinct cavity, particularly around small cored holes, which act as heat retainers, as shown in Fig. 2, although cavity and porosity will be pronounced in such a casting without a core.

The casting shown was poured through two ⅜-in. by 2-in. flat ingates at points X, and with 1-in. sq. area relief riser gates positioned at O. The mould was 80 per cent. faced with cast-iron denseners backed by sand, dried and allowed to cool. The metal poured into the casting was of the following composition:—Total carbon, 3.25; silicon, 1.6; manganese, 0.7; sulphur, 0.09; and phosphorus, 0.9 per cent. Such a dense sound casting cannot be obtained by any ordinary or special process, or any class of metal.

Fig. 2 shows the quality of casting obtained when metal of the same analysis as used in the densened casting (Fig. 1) is poured into a green-sand mould with three large self-feeder heads totalling 30 sq. in.

Figs. 3, 4 and 5 illustrate again the powerful influence of the mould materials on the soundness of cast iron. The example shown is a wheel lathe slide screw-nut blank casting, weighing approximately 20 lbs. The design is at right-angles to the face in the photograph, and almost semi-circular. The castings were poured as in the photographed position, through ½-in. sq. section ingates at the position 0, and with, in the case of Fig. 3, a 4-in. dia. self-feeder over the position X, and with examples Fig. 4 and Fig. 5 only a ¼-in. dia. relief riser gate at location X. Figs. 3 and 4 are examples poured in green-sand moulds. The example, Fig. 5, has 80 per cent. of outside area with denseners. The castings shown in Figs. 3 and 4 were poured in metal of the following composition:—Total carbon, 3.22; silicon, 1.30; manganese, 0.64; sulphur, 0.11; and phosphorus, 0.61 per cent.; and example, Fig. 5, was poured in metal of similar analysis to that given for the turret blank, Fig. 1. Fig. 3 is the best that can be obtained by ordinary methods. Fig. 4 shows the effect of omitting the feeder head and substituting the ¼-in. dia. relief riser gate only. The porosity and cavity is gas-and-liquid shrinkage. Fig. 5 shows a perfectly sound casting, which is poured into an 80 per cent. metal-faced mould without feeder head.

Fig. 1.—Cast-Iron Turret Head Block, weighing about 3½ cwts., Cast with Denseners on 90 per cent. of the Mould Surface.

Brinell readings taken on the three block castings at points 1 in. from the outside edge, and in the case of the Fig. 5 example in the absolute

Table I.—*Density of Castings from Green, Dry and Spun Moulds.*

Test No.	Alloy analysis per cent.						Type of Mould.	Temp. of Mould.	Runner and riser feeder heads sq. in.	Temp. of pouring.	Spun speed revs. per min.	Weight of casting plus headers.	Weight of dressed casting.	Per cent. head metal over casting weight.	Density.	Brinell hardness value.
	Cu.	Sn.	Zn.	Pb.	P.	Al.		Deg. C.		Deg. C.		lbs.	lbs.		gm./c.c.	1,000 kg. 10 mm. ball.
A1	87.75	12	—	—	0.25	—	Sand Green F	Normal	13	1,095	—	97	62	56.45	8.305	60.0
A2	87.75	12	—	—	0.25	—	Sand Dried F	Normal	13	1,095	—	99	62	59.76	8.24	64.0
A3	87.75	12	—	—	0.25	—	Sand Dried F	Normal	12	1,095	—	100	61	63.93	8.24	60.0
A4	87.75	12	—	—	0.25	—	Sand dried G	Normal	13	1,095	—	97	64	51.59	8.42	72.5
A5	87.75	12	—	—	0.25	—	Sand dried G	Normal	12	1,095	—	101	63	60.31	8.38	76.3
A6	87.75	12	—	—	0.25	—	Spun G	50	2	1,100	300	72	65	10.07	8.54	87.0
A7	87.75	12	—	—	0.25	—	Spun G	50	2	1,100	550	70	65	7.70	8.69	90.0
A8	87.75	12	—	—	0.25	—	Spun G	50	2	1,100	700	71	66	7.57	8.68	98.0
A9	87.75	12	—	—	0.25	—	Spun G	50	2	1,100	900	73	68	7.35	8.71	101.0
B1	82	12	—	6	0.02	—	Sand dried F	Normal	13	1,100	—	—	—	—	8.82	87.0
B2	82	12	—	6	0.02	—	Spun G	50	2	1,100	800	—	—	—	8.92	101.0
C1	70	—	30	—	—	—	Sand dried F	Normal	13	1,010	—	—	—	—	8.38	52
C2	70	—	30	—	—	—	Spun G	50	2	1,010	800	—	—	—	8.49	54
D1	6.25	—	1.2	—	—	92.55	Sand Green G	Normal	13	680	—	—	—	—	2.92	70.5
D2	6.25	—	1.2	—	—	92.55	Spun G	50	2	680	800	—	—	—	2.95	72.5
	C.C.	G.C.	Si.	Mn.	S.	P.										
E1	0.30	3.62	2.4	0.9	0.04	0.04	Sand Green F	Normal	13	1,375	—	—	—	—	6.91	90
E2	0.40	3.52	2.4	0.9	0.04	0.04	Sand Green G	Normal	2	1,375	—	—	—	—	7.045	137
E3	0.23	3.69	2.4	0.9	0.04	0.04	Spun F	50	2	1,375	800	—	—	—	6.92	95

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centre, and with Figs. 3 and 4 at a point ½ in. away and on two sides of the central porous area were as follow:—

Fig. 3.—Porous block, adjacent to centre 166 and outside 196.

Fig. 4.—Porous and cavity block, adjacent to centre 170 and outside 196.

Fig. 5.—Solid block, in centre 187 and outside 196.

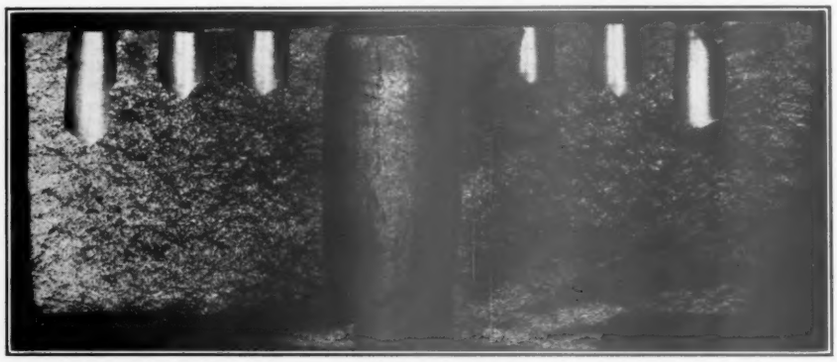

FIG. 2.—GREEN-SAND MOULD CASTING FED BY THREE LARGE HEADS, TOTALLING 30 SQ. IN.

Step Block Castings

In the next example a step-block test casting is used, weighing approximately 8 lbs. The photograph, Fig. 6, illustrates the pattern and design of the test casting with standard runner gate and relief riser attached. Fig. 7 shows what happens when metal of normal casting temperature, approximately 1,330 deg. C., is poured into a green-sand mould without feeding head; Fig. 8 is cast in the same way, but at approximately 1,290 deg C.; whilst Fig. 10 is made similarly, but with 80 per cent. of outside area covered with denseners, and a perfectly sound casting, absolutely free from porosity, is secured.

Fig. 9 is a photograph of a test block made in an 80 per cent. metalled mould and poured in a low-silicon, medium-phosphorus iron which shows but the slightest porosity in the lower heavy section. It was cast at 1,350 deg. C.

The analysis of the metal introduced into the test moulds is as follows:—

Figs.	T.C.	Si.	Mn.	S.	P.
7, 8 and 10 ..	3.26	1.58	0.64	0.10	0.86
9 ..	3.18	1.23	0.62	0.08	0.65

It will be noted that the test-block illustrated in photograph, Fig. 7, shows distinct gas-holes in addition to porosity. Mould and occluded gases are present, due to the slow rate of cooling. The test shown in Fig. 8, poured at a much lower temperature, illustrates vividly the effect of temperature on soundness. There are numerous gas-holes not all of which are disclosed by the photograph. Porosity is also as extensive as in test, Fig. 7.

Gear Blanks

Fig. 11 shows three sections of gear blanks used as a test for the effect of mould conditions on a hematite iron, the particulars of which are given in Table I. The section is 2½ in. by 3 in. and the diameter of the blank 13 in. The left-hand section G shows the result when poured into a green-sand mould through an ingate area ½ in. sq., and a feeder head of approximately 8 in. sq. General open grain is evident. The section J on the right-hand side was spun cast in dry sand in a "Craven" centrifugal casting machine. The middle section H was poured into a stationary green-sand mould, but with a ring densener around the whole of the outside of the rim. The same ingate area was used as with test G, but only a relief riser gate provided.

Table I will show that the casting poured into a mould with a ring densener is of greater density and hardness than the spun cast in sand. This test is shown to illustrate the enormous expansive and pressure effect on the metal structure when shell expansion is resisted and the speed of freezing accelerated.

It has been calculated that, when spinning gear blanks from 12-in. dia. to 24-in. dia. at 700 to 900 r.p.m., a pressure is set up equal to from 60 to 100 times that of gravitation. It is therefore evident that the pressure set up in the densened casting is much greater than that which is spun in a sand mould. This is only true of grey cast iron.

The next example shown in Fig. 12 illustrates a gear blank approximately 30 lbs. in weight, which, when poured in a sand mould with metal of the following composition, total carbon 3.25, silicon 1.62, manganese 0.68, sulphur 0.10, and phosphorus 0.74 per cent., and with ordinary feeder head, shows unsoundness. But when the same metal is spun cast in a dry-sand mould with a ring densener, an exceedingly dense casting is obtained, as disclosed by Fig. 13.

The photographs, Figs. 14 to 17, illustrate very profusely the action of both mould and occluding gases which occupy area in the casting section. Fig. 14 shows a section of refined pig-iron. It is obvious how gas from the pig sand bed has found its way into the metal and created not only a distinct gas-stream cavity, but also extensive porosity in the central area of over 2 sq. in. The defect may again be described as gas-and-liquid shrinkage.

In the next picture, Fig. 15, the upper section *k* shows blowholes due to pouring dull iron. They can probably be associated with mould and occluded gases. The lower portion L illustrates how the interaction of slag on the surface of the metal at X has affected the underlying metal, so that porosity has been intensified. The porosity communicates with the surface slag, although the photograph does not show this very clearly.

Fig. 16 illustrates at B blowholes from entrained air and slag passing into a test-bar mould along with the metal. Sections *c* and *d* show a 1-in. sq. by 14-in. test-bar; at E, a 1¼-in. sq. by 14-in. bar. All bars were poured with a metal analysing as follows:—Total carbon, 3.2; silicon, 0.9; manganese, 0.7; sulphur, 0.11; and phosphorus, 0.5 per cent. *c* was poured in a warm dry-sand mould and *d* and *e* in a cold green-sand mould. This test well illustrates the effect of mould conditions. The warm mould with the 1-in. sq. section yields a dense sound grey iron; the 1¼-in. sq. section is not quite grey throughout, and has a central pipe or blow-hole, surrounded by mottled structure. The

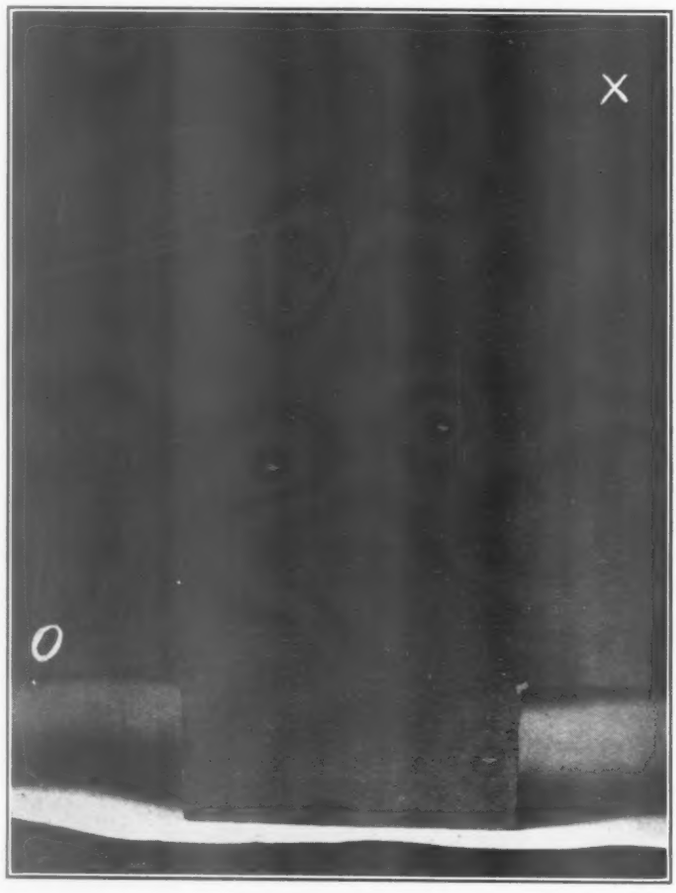

FIG. 3.—WHEEL-LATHE-SLIDE SCREW-NUT BLANK CASTING, POURED AT O AND FED AT X. WITH HEAVY FEEDER IN GREEN SAND.

Some Factors Influencing the Density and Soundness of Ferrous and Non-Ferrous Castings

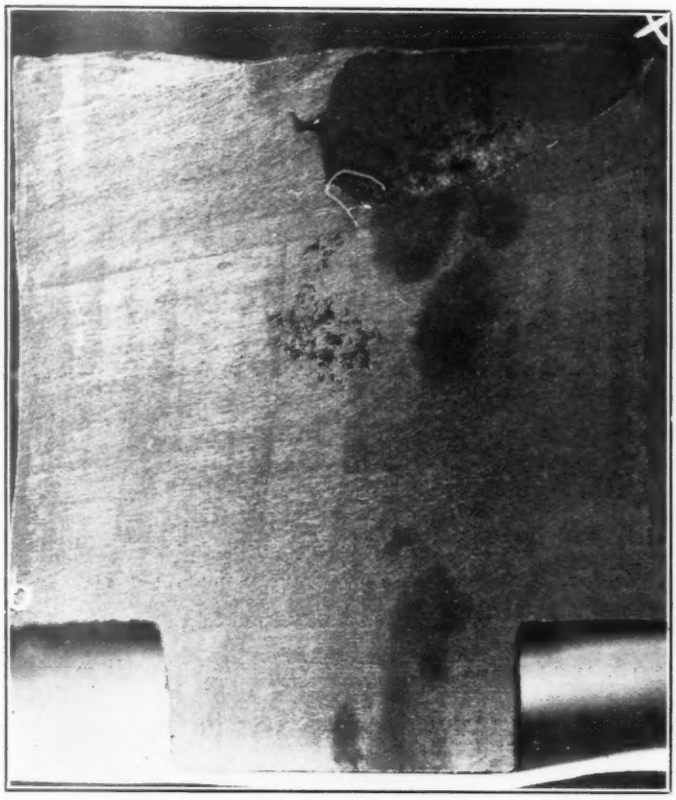

Fig. 4.—The Casting shown in Fig. 3, but with Relief Riser only.

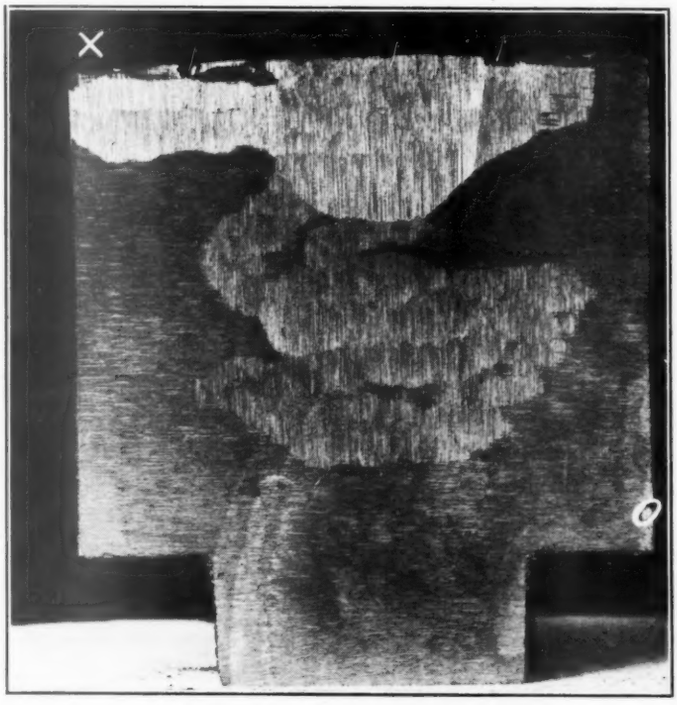

Fig. 5.—Similar to Figs. 3 and 4, but 80 per cent. of the Surface of the Mould was Metal Faced. No Risers Used.

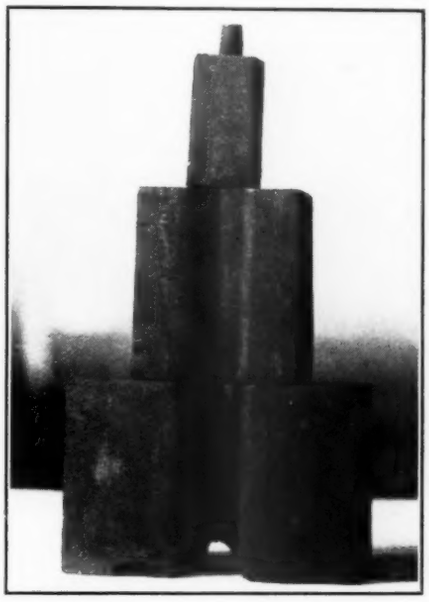

Fig. 6.—Pattern for Step Castings.

Fig. 7.—Test Block Cast in Green Sand, with ¼-in. Relief Riser.

Some Factors Influencing the Density and Soundness of Ferrous and Non-Ferrous Castings

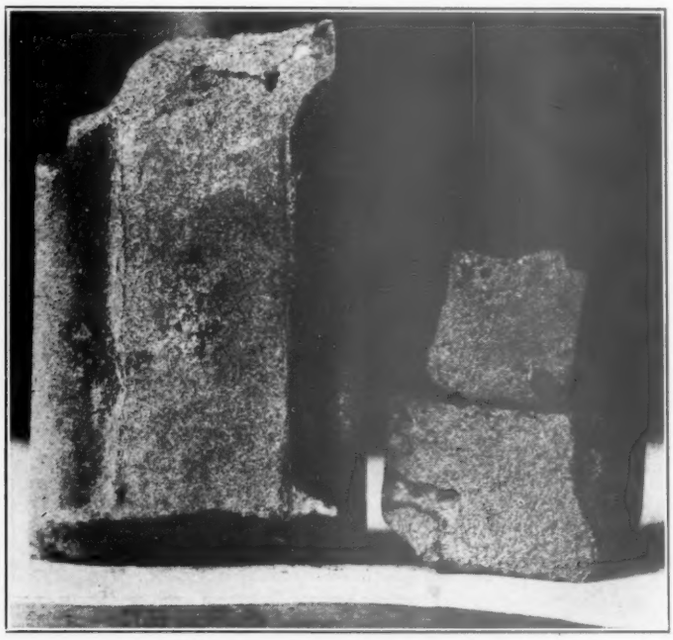

Fig. 8 is similar to Fig. 7, but Cast at Lower Temperature.

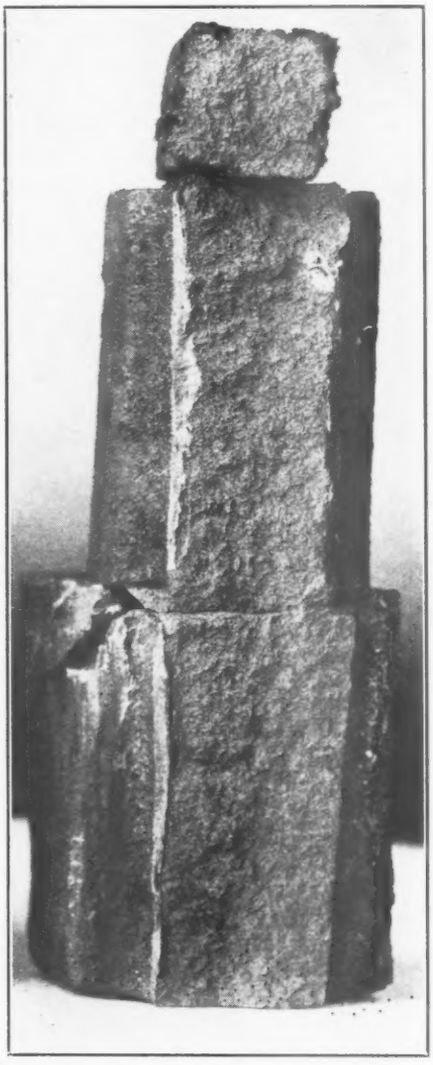

Fig. 10.—Test Casting using 80 per cent. Metal-lined Mould Surface.

Fig. 9.—Similar to Figs. 7 and 8, but 80 per cent. of the Mould Area covered with Denseners.

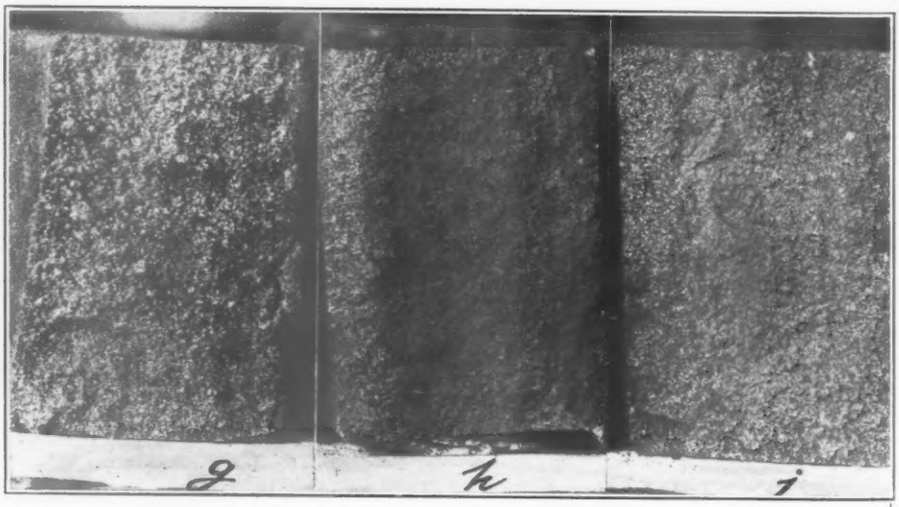

Fig. 11.—Gear Blanks Cast in Green Sand (*g*), Metal-Ring-lined Mould (*h*), and in a Spinning Machine (*j*).

Some Factors Influencing the Density and Soundness of Ferrous and Non-Ferrous Castings

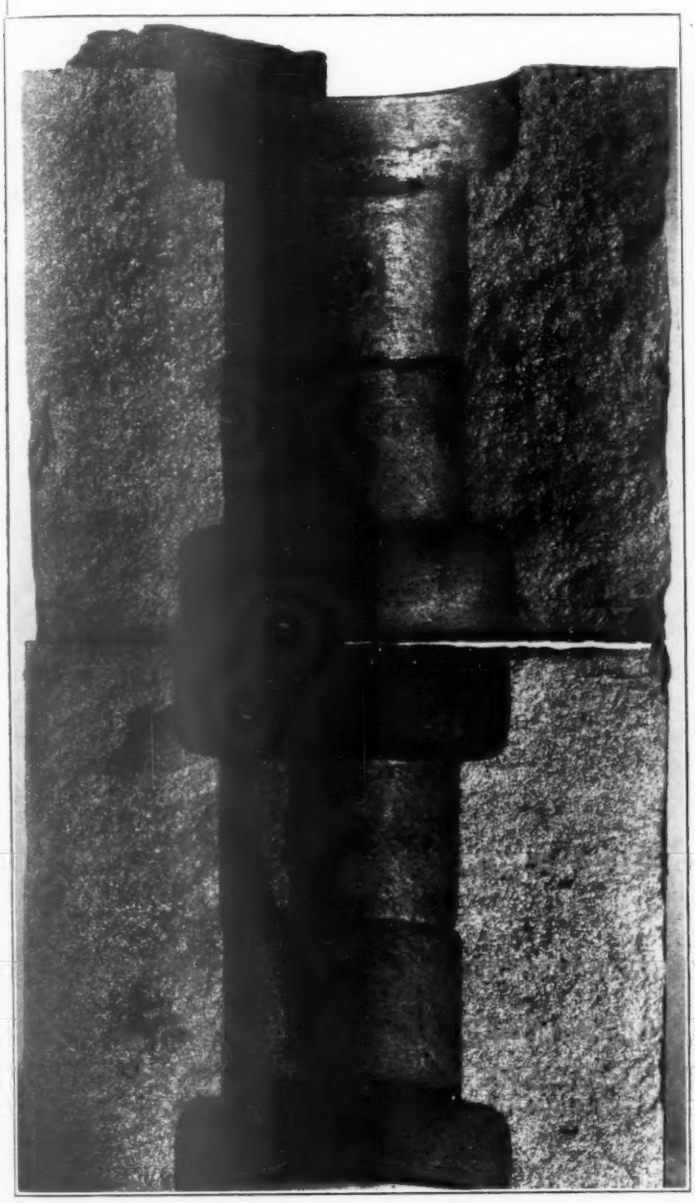

Fig. 12.—Gear Blank Cast in Green Sand, normally Fed, showing Unsoundness.

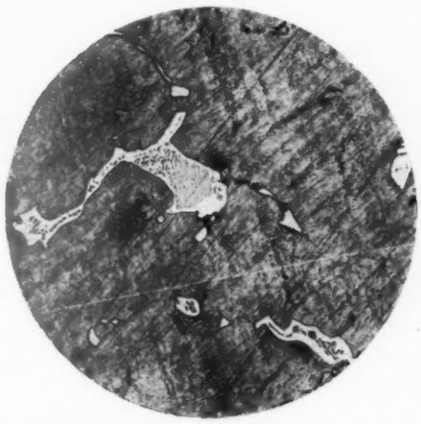

Fig. 20.—Ring-Chilled Bronze Casting. ×500.

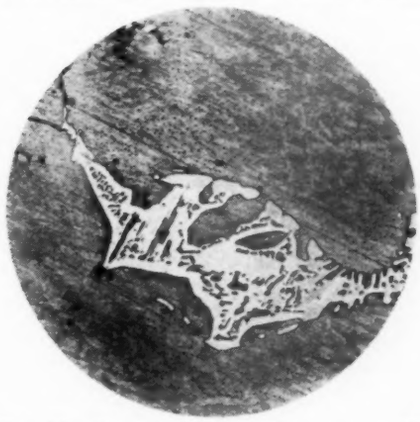

Fig. 19.—Sand-Cast Bronze Casting. × 500.

Fig. 13.—Centrifugally-Cast Gear Blank.

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Some Factors Influencing the Density and Soundness of Ferrous and Non-Ferrous Castings

Fig. 14.—Refined Pig-iron containing Cavity due to Sand Bed.

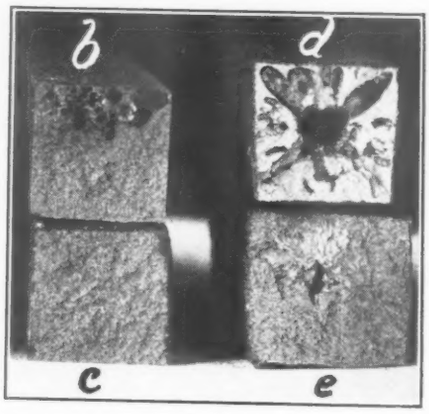


Fig. 16 shows Defects due to (*b*) Entrained Slag, and Cold Green-Sand Moulds (*d* and *c*).

Fig. 17.—Defect due to Careless Use of Vent Wire.

Fig. 15.—Defects due to Dull Iron and (lower) Slag Action.

Fig. 18.—Shows how Mould and Core Gases may affect the Soundness of Castings.

1-in. section cast in a cold green-sand mould is white across the section and heavily gassed. In the latter case the unsoundness is probably due to mould and occluding gas, in addition to the heavy liquid shrinkage consequent on retention of carbon in solution.

Fig. 17 shows a 2½-in. dia. by 14-in. cast-iron stick section poured horizontally and is very interesting. A complaint from the machine shop showed that castings held numerous blow-holes. The moulds were poured with a special crucible cast metal, which was well melted and of correct composition. The moulder was requested to make a mould and cast in the author's presence, and the latter noted that the moulder, in venting the bottom side of the mould, allowed venting wire to touch the face of the patterns. When the casting was broken the offending blow-holes were again present. It was evident that the mould gas was finding an easier passage through the exposed pricker holes on the mould face and into the metal than by the more difficult route

Fig. 21.—Centrifugally-Cast Bronze Casting. × 500.

via the bottom of the mould box, which was resting on a thin layer of sand on a plated metal floor. Another mould was made, with instructions to keep the vent wire away from the mould—the casting was perfectly sound as were also subsequent castings.

If gases affect comparatively simple castings as described, how much more difficult it is to produce castings with complicated coring without any defect whatever. With care the bulk of castings are produced without obvious defects.

It is stated that part of the art of the founder lies in moving the tendency of defects into sections where they will not be discovered. This is only true in a very limited sense, because with modern practice defects, both visible and invisible, are almost eliminated.

Non-Ferrous Castings

Most non-ferrous metals have a high liquid shrinkage, which varies from about 8 per cent. in common brass to about 10 per cent. in an aluminium bronze. If liquid shrinkage is of the order of 10 per cent. in an aluminium bronze, it means that each solid crystal occupies only 90 per cent. of the volume of the liquid from which it is formed. As with steel, the high liquid shrinkage imparts serious cohesive force and pressure on the crystal grains, conferring a high mechanical strength to a metal or hardness. Density and soundness in such metal as bronze is most markedly influenced by the freezing range as determined principally by the pouring temperature, condition of the mould, and section. Consequently, close study is made of correct pouring-temperature control by pyrometer, correlating the known cooling range of the particular alloy with the mass section of the casting being produced. Consideration must also be given to the sensible disposition of runner and riser-gate feeder heads. If the combination is well judged, the head metal will be seen to sink rapidly within a few seconds after pouring.

Bronze and aluminium alloys have high internal shrinkage and are very sensitive to oxide and gas absorption and inclusion. The use of chill or denseners in non-ferrous alloys does not function so effectively as with grey cast iron, which holds such large quantities of graphite carbon, etc., but the judicious application of denseners on heavy sections, or hot locations of a casting, will facilitate a rapid passage of such sections from liquid to solid, having drawn its quota of shrinkage metal from the later solidifying areas of the casting which will have more immediate contact with suitably located feeder heads.

The general effect of densening a section is to speed up the freezing of the entire casting, thereby creating the desired shortest freezing-range with its great influence on soundness and grain size. Gases absorbed during the melting of non-ferrous alloys, and the tendency for such gases to occlude on cooling, provides serious study if the maximum success is desired. The following gases are considered to be absorbed by metal during melting, along with gases already present in the material:—Hydrogen, oxygen, carbon monoxide, sulphur dioxide and nitrogen, etc.

The amount of gas absorbed and occluded will depend on the melting practice, pouring temperature and nature of alloy. A very slow cooling rate will favour the liberation of the maximum amount of gas, but will create general large crystals. An intermediate cooling rate will be conducive to the metal occluding gas which cannot liberate itself from the solidifying alloy and may result in general porosity, cavity and blow-holes. In aluminium this stage is characterised by the appearance of numerous pin-holes throughout the metal sections.

A rapid freezing rate gives little time for gases to become liberated. With gas so held in solution, very sound dense castings are produced. Aluminium has great propensities to absorb gases and is particularly sensitive to gas inclusion which, if not controlled, show up fine pin-holes, speckled metal and with general low density.

The excellent research work by Archbutt and Prytherch on the practical elimination of the baneful effect of uncontrolled gases in aluminium is well known. A process originated by Archbutt, and termed the pre-solidification process, consists of allowing the metal, after first melting, to solidify in the furnace or crucible, and to re-melt the metal and bring up to the required temperature sharply and pour into the mould. This process allows the free liberation of gases in such a light alloy as aluminium. When melting copper or aluminium, the formation of oxides should be prevented as much as possible, since oxides, once formed, are difficult to eliminate from the melt, due to the affinity of oxygen for such metals and the high-temperature melting point of the oxides.

Centrifugally Produced Castings

The almost complete control which can be exercised on the constitution of the metal, especially non-ferrous alloys of the bronze series, is well amplified in the production of castings by the centrifugal process. Table I outlines experiments and tests taken on a vertical "Craven"-type centrifugal casting machine, and will be largely self-explanatory. It will be noted that, with the exception of the special test on grey hematite cast iron to compare chill densening with that of spinning in sand, the spun castings, in a dry-sand mould with outside ring chill, indicated by the latter G, Table I, are of considerably greater density and hardness than those ordinarily produced in sand or chill densened. F, in Table I, indicates a sand mould and G that a ring chill has been employed. The metal samples for density and Brinell-hardness tests were in the sand castings taken from the most sound portion of the casting, away from the feeder heads. With the centrifugally-made castings, this was unnecessary.

It will be seen that the difference between the average of the sand castings and the castings spun at 900 r.p.m. is equal to about 4.8 per cent. in favour of the centrifugally cast. If due allowances are made for the greater porosity in the areas around the header junctions of the sand castings, it can safely be stated that a centrifugal casting spun at 900 r.p.m. is 5 to 6 per cent. heavier and denser than the average casting made under ordinary best sand-moulding practice with control of temperatures. The beneficial action and effect of centrifugal casting on the structure of metals will be well illustrated by an examination of Table I. Figs. 19 to 21 show the differences of the structure at 500 magnifications.

It will be noted that the alpha-delta eutectoid-hard constituent is more evenly distributed in the matrix of alpha copper-tin solid solution—softer constituent—in the spun cast, Fig. 21, than in either Figs. 19 or 20, sand cast and ring chilled respectively. Fig. 20 shows a poor and low distribution of the necessary hard constituent due to the differences of cooling rate between the chill and away from same. In the sand-cast metal, Fig. 19, there are very obvious gas inclusions, as blowholes and fissures, and to a smaller extent in Fig. 20.

In conclusion, the author wishes to express his appreciation and indebtedness to Mr. R. Greenwood, managing director, Craven Bros., Limited, machine-tool engineers, Manchester, for the facilities and help in carrying out the experiments and tests, and for his constant encouragement to examine scientifically any phase of foundry work which will be of advantage in producing better castings. He also wishes to thank Mr. Hopwood, brass-foundry foreman, for help in carrying through the experiments and tests on still sand-cast and centrifugal-cast comparisons.

Thermal Properties of Co-Fe-Cr Alloys

According to his Paper, "On the Thermal Expansion of Alloys of Cobalt, Iron and Chromium, and a New Alloy 'Stainless-Invar,'" in the Science Reports of Tôhoku Imperial University, H. Masumoto has measured the thermal expansion of ternary alloys of cobalt, iron and chromium, and has found that an addition of a small quantity of chromium to cobalt-iron alloys containing more than 50 per cent. of cobalt considerably reduces their thermal expansion. The measurement of the thermal expansion of alloys with a small expansibility was made from the temperature of liquid air to the vicinity of the magnetic transformation point, and the range of temperature available for this small expansibility was examined. The smallest coefficient of linear expansion at 20 deg. found was -1.2×10^{-6}. It was also found that alloys having a small expansibility were practically incorrodible in dilute solutions of common salt. Some physical properties of these alloys were also determined.

B.T.H. Fractional H.P. Motors

A special feature of a new range of fractional horse-power motors, being manufactured by the British Thomson-Houston Company, Limited, is the choice of mounting. All standard ball-bearing motors up to ¼ h.p. are provided with feet cast solid with the endshield, and above ¼ h.p. the machines have a pressed steel or cast base; moreover, all sizes can be supplied with alternative mechanical features. For instance, motors can be provided with feet or base and spigoted endshield, or, alternatively, without feet or base, but with spigoted endshield, which allows the motor to be built in, or carried on, a customer's machine. Another design of motor is built without feet or base and without spigot, this arrangement allowing the motor to be secured to the cradle formed by the driven machine by four bolts screwed into holes provided in the frame, which can be mounted horizontally, vertically, or at any desired angle.

XUM

The Estimation of Molybdenum in Cast Iron and Steel

By C. Thompson and J. Stott (Keighley Laboratories)

The increasing use of molybdenum as an alloy addition to cast iron and steel brings with it the problem of suitable methods of analysis. As regards cast iron, the presence of phosphorus has been found to give difficulty in the estimation of molybdenum by the generally-accepted methods. The following method has been found to give satisfactory results and has the advantage of being fairly rapid, the time required being 1½ to 2 hrs., as compared with 4 hrs. by the more usual sulphide method. The method to be described is based on the use of α-benzoinmonoxime, and the principles involved are described in a Paper by H. B. Knowles in the Bureau of Standards, "Journal of Research," Vol. 9, Part 1, 1932.

The details of the method for cast iron are as follow:—1-gm. sample is dissolved in 35 ml. nitro-sulphuric acid, as in the silicon estimation. The solution is evaporated to dryness and fumed, the cake being dissolved in 60 ml. of dilute sulphuric acid (1:6). The solution is filtered, washing well with dilute sulphuric acid. The volume of filtrate is made up to approximately 200 ml. and a few ml. of ferrous ammonium sulphate added to reduce chromates and vanadates (sulphurous acid may be used if excess SO_2 is expelled). The solution is cooled to 10 deg. C. and 10 ml. of the reagent added, followed by a few drops of bromine water and then a further 5 ml. of reagent. After standing for 15 min., the precipitate is filtered off through a No. 41 Whatman paper and well washed with a solution* of the reagent and sulphuric acid. The filter paper and contents can then be ignited to MoO_3 at a temperature of 500 deg. C. (containing 66.15 per cent. Mo). It has been found that the precipitate is usually contaminated with iron, and it is advisable to re-dissolve in 20 per cent. sodium hydroxide solution and filter out any insoluble matter. The solution is then acidified with acetic acid and boiled and 30 ml. of 4 per cent. acetate solution added. After boiling for 15 min. the lead molybdate is allowed to settle and is filtered on a pulp pad and washed with hot water. The precipitate is ignited to $PbMoO_4$, containing 26.15 per cent. Mo.

The application to steel is more simple, the solution being made in sulphuric acid (1:6), followed by oxidation with a minimum amount of nitric acid. Tungsten must be removed if present. The procedure is then as in cast iron.

The reagent is made by dissolving 25 gm. of α-benzoin monoxime in 250 ml. alcohol (1 per cent. solution). It has been found that phosphorus does not interfere in this method, and an advantage is that molybdenum shows if present only in traces.

The above method has been given extended trial at Messrs. Keighley Laboratories, Limited, and has proved to be entirely successful. Acknowledgments are due to the directors of that company for permission to publish the details.

* The filtrate from the Molybdenum precipitate deposits needle-like crystals after standing, this is α-Benzoin-Oxime coming out of solution and can be ignored.

Decomposition of Cementite

On heating pig-iron to 500 deg. C. the Fe_3C is not decomposed, but at 600 deg. appreciable decomposition takes place and increases with the pressure, according to A. BRÜCHANOW in "Zeit. f. anorg. Chemie." As the temperature is raised the stability of the Fe_3C steadily diminishes, the effect of pressure gradually becoming less marked. Above 800 deg. pressure has practically no effect on the velocity of decomposition.

Industrial Lighting

The annual Report* of the Chief Inspector of Factories and Workshops for the year 1933, referring to industrial lighting, points out that the lighting of factories (though apart from a few special instances there are no legal standards of efficiency) has again received attention from the whole staff, and in addition has been made the subject of a special investigation by Mr. R. W. Daniel. This investigation, which was confined to the artificial lighting of factories in the City of Sheffield, has shown that in the larger factories the principal defect is glare and general unsuitability of the lighting systems rather than inadequacy of the actual illumination. This inquiry, for instance, in which the City Council showed great interest, has led to some remarkable results in the direction of improved lighting. Out of 475 factories visited only 27 were found already to possess really up-to-date installations. In the remainder the recommendations made, following various tests and demonstrations by a direct-reading photometer, have led to improved conditions, wholly or partly completed, in 128 factories, and in 17 more similar progress is anticipated.

In the South of England the lighting exhibit of the Home Office Industrial Museum is known to be the cause of considerable advance, and the lectures on lighting have been advantageous in many parts of the country. In a large engineering works small light units which were sources of glare, as well as being inadequate, were replaced by a system of general direct illumination, with such a saving in wattage that it is estimated that the cost will be recovered within a reasonable time.

In a large steelworks an ingenious system of lighting has been adopted in an effort to reduce traffic accidents where a number of doorways open directly on to the permanent way. The source of light is focussed to illuminate the full length of the permanent way along this series of doorways and at the far end impinges on a photo-electric cell. As an approaching engine or vehicle nears the doorways its intrusion cuts off the light beam from the cell. By the action of an intermediate relay, red danger signals at once glow in all doorways opening on to this particular length of track. In the same works, Osira gaseous-discharge general units, providing a floor illumination of eight foot-candles, are controlled through relays by photo-electric cells in two circuits. As daylight fades, the lighting is automatically switched on in two stages.

Improvements in lighting have been noted in the introduction of flood lighting in a large constructional engineering works and in the fitting of lamps on the underside of overhead cranes to bring the light over the spot where it is wanted as the crane moves about. The use of frosted-glass lights of large area has been found most satisfactory in producing a strong shadowless light in all parts of a modern power station, where good general lighting is essential for the reading of the numerous recording instruments.

Lighting by gaseous-discharge lamps is making some headway in industrial undertakings. All reports so far refer to the mercury type of lamp. This method of lighting has been found in iron foundries and steel-smelting shops, loading bays and outside road lighting. The advantages claimed are that this type of lighting, being even and nearly shadowless, is particularly well suited for certain classes of work, such as small moulding work and fettling in foundries. The lighting of file-cutting and certain other machines by low-voltage (12 volt, 18 watt) local points proved to be very successful. For the inspection of safety-razor blades both mercury-vapour and daylight lamps have been installed.

* H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2. (Price 2s. net.)

Book Review

The Hardness of Metals and its Measurement, by HUGH O'NEILL, D.Sc., M.Met. Published by Messrs. Chapman & Hall. Price 25s. net.

This monograph is of great importance as an attempt to co-ordinate in one volume the vast amount of literature which has grown up during the last thirty years in connection with the property of hardness and the methods of hardness testing of metals. Dr. O'Neill, the author, is well known as a result of his continuous and devoted application to the study of the hardness property over a long number of years. His own work has contributed in no small measure to a better and more orderly conception of the property of hardness and the interpretation of the results of the various methods of hardness testing. The need and the justification for the author's task in compiling this monograph is amply demonstrated by the Bibliography, which occupies ten pages at the end of the book, and consists of a total of four hundred and ten references. This, it is pointed out, does not purport to be a complete bibliography on the subject of hardness; it is only a reference to the original sources for the various statements made throughout the course of the book.

The whole subject is well covered in a series of nine chapters, three of which deal with the various methods of hardness determination, together with a description of typical apparatus for static and dynamic indentation tests. The relation of hardness to deformation and strain-hardening, the crystallinity of metals and alloying and heat-treatment, occupies a further three chapters, whilst the final three chapters deal with tests on soft metals, tests on hot metals, the preparation and examination of hardness-test specimens, and an essay on the subject of abrasion, machinability and cutting hardness. A short appendix gives a series of conversion relationships of the various modern hardness scales used in industrial hardness testing, followed by the bibliography and a complete index of authors and subject-matter.

The opening sentence in the introductory essay, that "The hardness of metals, like the storminess of seas, is easily appreciated but not readily measured," will be well understood by all those who have had to give consideration to this matter. In this essay the author reviews, in a most concise and admirable manner "the conception of hardness" as it has appealed to those philosophers, physicists and mechanicians who have worked on this problem. In the author's own words, "it would perhaps not be surprising to learn that this work had failed to yield anything of real utility." The very reverse, however, is the case. In the realm of hardness, practice has outstripped theory, and the various technical hardness tests have been of greatest value to industry for judging and controlling the quality of metallic products.

Of all the industrial tests applied to metallic products, it is probably true to say that the hardness tests are by far the most important, and, on this account, every inquirer and metallurgist should find Dr. O'Neill's book indispensable.

J. E. H.

THE VIADUCT connecting Bowness, on the English side of the Solway, with Annan, on the Scottish side, known as the Solway Viaduct, is being demolished. It is 1,960 yds. in length, has 200 piers, and is constructed mainly of cast iron. It was originally built in 1869 by the Solway Junction Railway for the conveyance of iron ore from Cumberland to the steelworks of Lanarkshire. Storms caused considerable damage to the structure in the winter of 1875, and it suffered still more extensively from the great frost of January, 1881. During the thaw after the great frost of 1875 heavy ice-floes carried away many of the piers, besides inflicting other damage. It was repaired and reopened in 1884 by the Caledonian Railway, but since 1921 the bridge has been closed and derelict.

This Week's News in Brief

Trade Talk

THE NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED, Glasgow, are to supply nine sets of locomotive cylinders for the East Indian Railway.

MESSRS. SMITH'S DOCK COMPANY, LIMITED, have booked further orders for eight deep-sea trawlers for Hull and Grimsby owners. They will be fitted with engines built on the premises.

THE CONSETT IRON COMPANY, LIMITED, recently took the opportunity to transform the major portion of the electrical plant at their works to conform with the National Grid requirements.

THE B.C.I.R.A. EXPERIMENTAL CUPOLA of the balanced-blast type, which has been erected in the foundry of Preston & Bishop, Limited, Clement Street, Birmingham, a few minutes away from headquarters, was recently put into commission, and should prove a valuable addition to the Association's experimental resources.

AT THE INVITATION of the Pig Iron Sub-Committee, the Blast Furnace Committee of the Iron and Steel Industrial Research Council (British Iron and Steel Federation) has nominated two representatives, these being Major H. H. Jackson, of the Clay Cross Company, Limited, Clay Cross, near Chesterfield, and Mr. G. H. Johnson, Kettering Iron & Coal Company, Limited, Kettering.

AT A RECENT MEETING of the Council of the British Cast Iron Research Association, Messrs. Crossley Bros., Limited, Manchester (Representative: Mr. G. Thornburn); Miller & Company, Limited, Edinburgh (Representative: Mr. L. T. M. Gray, Ph.D., B.Sc.), and The Millom & Askam Hematite Iron Company, Limited, Millom (Representatives: Major A. Hibbert, D.S.O., M.C., and Mr. H. Stewart Craig, C.A.) were elected as members. The United Molasses Company, Limited, London (Representative: Mr. H. D. Todd), were elected as trade members.

THE FOURTH OF THE GREAT PROPELLERS for No. 534 has been conveyed from the Charlton works of Messrs. J. Stone & Company, Limited, and shipped direct to the Clyde. The propeller could not be sent to the Clyde by rail owing to its size, and to have used road haulage throughout would also, it is stated, have been practically impossible. It had to be conveyed from Charlton to the docks by night because, owing to its great size, it could not be moved on the public roads while tramcars were running. It is wider than an omnibus and a tramcar side by side and weighs 35 tons. At Canada Dock the propeller was lifted by one of the Port of London Authority's huge floating cranes on board the s.s. "Pradda" for shipment to the Clyde.

THE LONDON MIDLAND & SCOTTISH RAILWAY has introduced into traffic the first of a series of 70 two-cylinder, six-coupled, mixed traffic locomotives which have been designed by the chief mechanical engineer, Mr. W. A. Stanier, for working both passenger and freight trains. Twenty of these engines are being constructed at the L.M.S. Crewe works, and 50 by the Vulcan Foundry, Limited, under the 1934 locomotive programme. Each engine is 63 ft. long and weighs 114 tons in full working order, including a six-wheeled tender accommodating 4,000 galls. of water and 9 tons of coal. An interesting constructional feature of the boiler, which carries a steam pressure of 225 lbs. per sq. in., is that a proportion of nickel-steel plates has been used to save weight.

THE SOUTH AFRICAN IRON AND STEEL INDUSTRIAL CORPORATION'S works at Pretoria were officially opened by the Countess of Clarendon recently, in the presence of 4,000 guests. Dr. H. J. van der Bijl (chairman) predicted that the industry would become an important national asset, exerting an influence on the country's economic future, adding that arrangements had been made for the disposal of 100,000 tons of steel annually, which, added to contracts for the other products of the works, was an excellent start and might well do much to ensure the financial success of a great enterprise. The Earl of Clarendon (Governor-General of South Africa) commended the enterprise, which, he said, would open up new channels of employment to South African youth. The inception of the iron and steel industry was a further indication of the South African people's virility and resourcefulness.

DISCUSSING PROBABLE profits in the U.S. iron and steel industry, the Standard Statistics Co. states that it is estimated that 11 leading steel producers, comprising 84 per cent. of total domestic ingot capacity, earned an aggregate net profit of approximately $16,500,000 in the June quarter this year. This was the first composite net profit shown by the industry for any three months' period since the first quarter of 1931, and compared with an aggregate loss of $7,422,000 in the January-March interval this year. The third quarter, it is stated, will again find the industry as a whole operating at a deficit, the composite loss likely to be at least as large as that shown for the initial 1934 quarter. On the basis of present indications, fourth quarter results should be almost large enough to wipe out this deficit, and enable the steel trade to break even for the full year, thereby making the best showing since 1930.

Contracts Open

Harrogate.—Class C vertically-cast iron spigot and socket pipes, in 9 ft. lengths, for the Corporation.

London, E.C., September 10.—The M.W.B. invites tenders for cast and spun iron pipes for six and 12 months. The Chief Engineer, Offices of the Board (Room 122), 173, Rosebery Avenue, E.C.1.

Tolleshunt D'Arcy, September 3.—Supply of four miles 1,390 yards 4-in. and one mile 1,720 yards 3-in. dia. cast-iron pipes, for the Maldon R.D.C. Mr. W. Almond, engineer to the R.D.C., 6, Market Hill, Maldon, Essex.

Trowbridge, August 27.—The Trowbridge, Melksham and District Water Board invites tenders for supplying an electrically-driven turbine borehole pump, capacity 20,000 gallons per hour. The Engineer to the Board, 22, Silver Street, Trowbridge.

New Company

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

H. & E. Lintott, Limited, Foundry Lane, Horsham.—Capital £10,000 in £1 shares. Ironfounders, mechanical engineers, etc. Permanent directors: H. J. Lintott and E. W. S. Lintott.

Obituary

THE DEATH OCCURRED on Saturday, at his residence, Netherpark, Uddingston, of Mr. John Gray Weddell, F.C.I.S., director and secretary of Messrs. Hurst, Nelson & Company, Limited, wagon builders, Motherwell. Mr. Weddell began his career with Messrs. Forman & McCall, civil engineers, Glasgow, and subsequently entered the service of Messrs. Hurst, Nelson & Company, Limited, of which firm he was secretary for over 30 years. He was also a director of Waggon Repairs, Limited, Birmingham.

Metallurgical Conditions in the Basic Process

P. BARDENHEUER and G. THANTHEISER, in Report No. 280 of the steelworks sub-committee of the Verein deutscher Eisenhüttenleute, published in "Stahl und Eisen," describe further researches into the metallurgical conditions obtaining in the basic process, in which the effects of varying the concentrations in the melt and the slag during the blowing period were studied for nine charges. By analysing the slag obtained in the reaction and freed from free lime, the basicity of the slag was determined also at the commencement of the melting process, as well as the transition conditions for conversion of an initially-acid slag into a basic one studied. This inversion has a marked effect on the behaviour of the elements other than iron present. Variations in concentration are shown to be reliable criteria of the velocities of transformation of Si, V, Ti, Mn, P and C dissolved in the iron, under the prevailing conditions.

Personal

MR. L. LEE, who is a member of the B.C.I.R.A. staff assisting Dr. Skerl at Sheffield, has been awarded the Mappin Medal and a premium for being the best evening student in metallurgy who has passed the Associateship Examination of the University of Sheffield.

LT.-COL. K. C. APPLEYARD has been elected a director of Koppers Coke Oven Company, Limited. He is also managing director of the Birtley Company, Limited, and its associated companies abroad, a director of the Société de Foncage de Puits Franco-Belge, and of Mining & Civil Engineering Contractors, Limited, and is chairman of the North-East Coast Engineering Employers' Association.

Wills

FULTON, L. W., Greenock, chairman of Messrs. P. MacCallum & Sons, iron and steel merchants, Greenock ... £369,854

MARCHANT, JAMES, of Huddersfield, chairman of directors of S. M. Marchant, Limited, engineers and brassfounders £6,878

HUNT, J. E., of Hope, Derbyshire, managing director of the Hallamshire Steel & File Company, Limited, Sheffield £13,611

FORD, W., of Allanford, Melfort Avenue, Clydebank, for nearly 35 years in the service of John Brown & Company, Limited, engineers and shipbuilders, Clydebank £18,207

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Sandblasting and Silicosis

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—We have read with considerable interest the leading article contained in your issue of August 9 and also the Home Office Report on Silicosis. We realise, however, that the grave position which Dr. Merewether outlines is a matter which can readily be remedied and, in fact, a matter which has been overcome by quite a number of firms who appreciate the necessity for efficient plant.

In the first place it is definitely a fact that the majority of plants at present in use are old and obsolete. The severe slump through which industry has passed has precluded the spending of money on bringing plant up to date.

The danger of silicosis can be greatly reduced, if not entirely prevented, by the installation of a modern plant with an adequate exhausting system and the provision of suitable dust collectors of the fabric type. If the exhausting system be well designed all dust leakage will be inwards and the operator cannot inhale the dust, nor will the workers adjacent to the sandblast plant be affected.

In conclusion, we would repeat that the trouble is one which can be quickly overcome by the installation of the correct type of plant.—Yours, etc.,

For St. George's Engineers, Limited,
(Signed) F. W. WILSON,
Director.

Ordsall Lane, Trafford Bridge,
Manchester, 5.
August 16, 1934.

Forthcoming Event

Institute of British Foundrymen

SEPTEMBER 5.

London Branch:—Presidential address. Followed by "The Aims and Objects of the Institute," Paper by T. Makemson.

Raw Material Markets

Activity in the iron and steel markets is now gradually quickening, and it is evident that the next week or two will see the commencement of a buying movement of no small dimensions. Many contracts will be expiring shortly, whilst stocks of material held by consumers have been allowed to run low during recent months. The volume of new orders for pig-iron has been rather small as yet, however, although the demand against current contracts has been quite satisfactory for the season.

Pig-Iron

MIDDLESBROUGH.—The current home demand for Cleveland foundry iron is quite up to the normal level for the time of year, and conditions would be quite satisfactory from the producers' point of view were it not for the lack of export trade. There is quite a fair volume of overseas inquiry, but the export quotations for Middlesbrough iron, although low, are not low enough in the majority of cases to compete with iron from other English districts and from the Continental works. Terms of sale for shipment to foreign destinations are irregular and not easily ascertained, but for other than export trade fixed zone prices are firmly adhered to. No. 3 G.M.B. is 67s. 6d. for use at local works, 69s. 6d. delivered to North of England areas beyond the Tees-side zone, 67s. 3d. delivered Falkirk and 70s. 3d. delivered Glasgow. Local holidays have brought the consumption of pig-iron in the Middlesbrough district to a low level during the current week.

Producers of East Coast hematite are well sold for some considerable period ahead. The current demand is heavy enough to take up practically the whole output. Those makers who have any iron in stock are not desirous of selling at the present rates, as they believe that an increase in hematite values is overdue, having regard to the increased costs of coke and ore. In the meantime, fixed delivered prices for home business are based on No. 1 grade of iron at 68s. here, 74s. to 77s. supplied to various parts of Yorkshire, 70s. Northumberland and Durham and 75s. Scotland.

LANCASHIRE.—The demand for pig-iron is gradually resuming its usual volume. The number of delivery suspensions in force has decreased, and normal trading activity in this area should shortly be in force. Rather more activity is reported in certain sections of the iron-consuming trades. Prices for delivery in the Lancashire area are steady generally. Lancashire iron equal to Derbyshire No. 3 is quoted on the basis of 74s. per ton, with Staffordshire, Derbyshire, and North-East Coast brands all offered at the same figure, Northants at 72s. 6d., and Lancashire iron equal to Northants at 72s. 6d. There has been little or no improvement in the demand for Scottish foundry iron in this area, but at around 82s. 6d. per ton, for delivery equal to Manchester, prices show little change. East Coast hematite is quoted at 76s. for No. 1 grade and 75s. for No. 3, both unbroken, whilst West Coast is offered for delivery in Lancashire at about 80s. 6d.

MIDLANDS.—Deliveries of pig-iron against old contracts have now been resumed, but there is still a shortage of new business. However, activity in the latter direction is expected to improve shortly. Prices remain unchanged, the levels for Midland brands being 67s. 6d. for No. 3 Northants and 71s. for Derbyshire, Lincolnshire and Staffs No. 3, delivered to Birmingham and Black Country stations, and subject to a small rebate to large consumers. Hematite pig-iron is in steady demand. Prices are unchanged and these are 84s. 6d. for West Coast and 78s. for East Coast, both delivered this area. Welsh hematite being somewhat under the latter price at about 77s. to 77s. 6d. Prices of medium-phosphorus iron have not altered much. Scottish iron comes into the district in steady but small quantities at about 85s. to 87s. 6d. per ton. There are various medium-phosphorus pig-irons to be obtained at about 73s. to 80s., and special refined irons rule from £5 10s. to £7 per ton.

SCOTLAND.—The demand for Scottish iron remains quiet. There is no change in prices at 70s. f.o.t. furnaces for No. 3 foundry, with 2s. 6d. per ton extra for No. 1. Imports of Cleveland iron have expanded within the last week or two, the consuming trades being active and likely to remain so for the remainder of the year. Quotations continue at 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow for No. 3 Cleveland.

Coke

Business in coke has not been very active lately. There has been little change in prices. Quotations for delivery in the Birmingham area are as follow:—Best Durham coke, 36s. to 40s.; other grades, down to 35s.; Welsh coke, 37s. 6d. to 45s., according to grade; best Scottish coke, 40s. to 41s. per ton.

Steel

The inactive markets which have ruled for the past few weeks have been due to seasonal causes, and with the approach of the end of the month the volume of inquiry has noticeably increased. Prices in all departments remain firm and in some have a tendency to advance. In the semi-finished steel department, business has been quiet but steady. The works producing this class of material have a substantial tonnage of orders in hand and are in a position to face the seasonal quietness with confidence. The sale of Continental material has not been pressed so much of late in the British market, as it is understood that the Continental makers have taken orders from Russia and the Near East, which have provided an outlet for their production. Irregular conditions have ruled in the finished-steel section, but, although new business has been rather quiet, the works, as a general rule, are well situated as regards orders. Business with the export markets also is showing signs of improvement.

Scrap

In the Cleveland area, slightly more business is reported in machinery cast-iron scrap at about 52s. 6d., heavy metal remaining steady at 50s. There continues to be a good demand for scrap in the Midlands, prices remaining at the levels that have ruled for many weeks. In South Wales, heavy cast iron is in more active demand, and prices are slightly firmer at 46s. to 47s. 6d. Light cast-iron scrap is also slightly improved at 41s. to 42s. 6d. There is still only a limited demand, however, for good cast-iron machinery scrap, quoted at 50s. to 52s. 6d. In Scotland, machinery cast-iron is at 55s. to 56s., and ordinary cast-iron scrap at 51s. 6d. to 52s. 6d. per ton.

Metals

Copper.—The industrial consumption of copper in this country keeps up to a fairly good level, although it is true that the amount of buying during the current month has not been large. The falling-away in the amount of interest shown by buyers is, however, largely a seasonal fluctuation.

At the same time, a number of unfavourable factors continue to influence the market, with the result that prices have shown no inclination to rise from the low level that has lately prevailed. German consumption of copper is being considerably reduced by official decrees which affect every department of the working-up industries. The seriousness of the market situation has caused rumours to circulate as to the possibility of an international conference being convened for the purpose of controlling copper output, but there seems to be little or no basis for these statements.

Statistics, which have been issued unofficially, relating to the world copper trade during July, reveal that American consumption fell to 29,813 tons (short) during that month, as compared with 46,424 tons in June—a distinctly disappointing result, it is felt.

Daily market prices:—

Cash.—Thursday, £28 to £28 1s. 3d.; Friday, £28 2s. 6d. to £28 5s.; Monday, £27 15s. to £27 16s. 3d.; Tuesday, £27 13s. 9d. to £27 15s.; Wednesday, £27 18s. 9d. to £28.

Three Months.—Thursday, £28 8s. 9d. to £28 10s.; Friday, £28 10s. to £28 11s. 3d.; Monday, £28 2s. 6d. to £28 3s. 9d.; Tuesday, £28 to £28 1s. 3d.; Wednesday, £28 5s. to £28 6s. 3d.

Tin.—The tin market has shown an uncertain tendency during the past week, and the outlook is rather obscure at the moment.

Messrs. Rudolf Wolff state in their weekly report that "at the meeting of the International Tin Committee the quotas of production were reduced by 10 per cent., and it was in anticipation of this, and subsequently on confirmation of the earlier rumours, that the price advanced to over £231, sellers showing a good deal of reserve. Later, when it became apparent that buyers showed no disposition to follow the advance, and, in fact, viewed the outlook with some mistrust, moderate liquidation took place and, with little support forthcoming, prices declined and practically the whole of the earlier advance was lost, the market recovering somewhat later, however. It might be inferred that the reduction in the quotas has scarcely counterbalanced the effect of the uncertainties prevailing in America and the unsettled conditions which still obtain on the Continent, and it would seem that the market requires a further measure of support to tide over the position until such time as consumption gives some indication of improving again."

Price fluctuations:—

Cash.—Thursday, £228 5s. to £228 10s.; Friday, £228 12s. 6d. to £228 15s.; Monday, £228 10s. to £228 15s.; Tuesday, £227 10s. to £227 12s. 6d.; Wednesday, £226 5s. to £226 10s.

Three Months.—Thursday, £228 5s. to £228 10s.; Friday, £228 12s. 6d. to £228 15s.; Monday, £228 10s. to £228 15s.; Tuesday, £227 10s. to £227 12s. 6d.; Wednesday, £226 5s. to £226 10s.

Spelter.—The demand for this metal is irregular, but there is still a shortage of prompt supplies on the London market. The uncertainty of the position is perhaps influencing consumers to hold off the market.

Day-to-day quotations:—

Ordinary.—Thursday, £13 13s. 9d.; Friday, £13 17s. 6d.; Monday, £13 16s. 3d.; Tuesday, £13 15s.; Wednesday, £13 15s.

Lead.—"In this country there has been rather less demand from consumers, due to the falling off in sales of manufactured products, which is not unnatural at this time of the year. The prospects of the cable industry, however, are distinctly brighter, and this will doubtless be reflected in an improved demand for the raw material later in the year. It is too early to state what effect the silver legislation in America will have. It seems likely that, in the case of lead, a higher silver price would cause a greater increase in production than in consumption," report Messrs. Brandeis, Goldschmidt.

Price fluctuations have been as follow:—

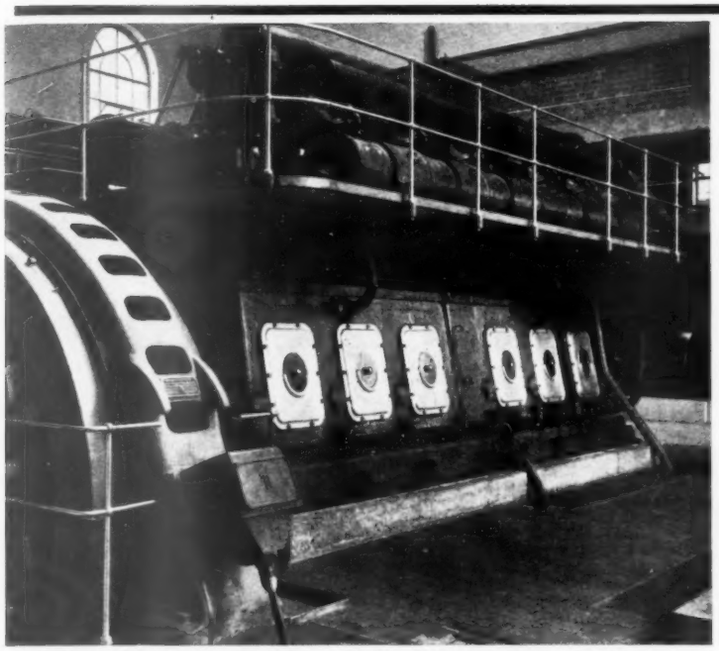
Soft Foreign (Prompt).—Thursday, £10 15s.; Friday, £10 16s. 3d.; Monday, £10 15s.; Tuesday, £10 15s.; Wednesday, £10 15s.

ALL CLASSES OF WORKERS in the light-castings industry will benefit by a decision to revert to the rates of remuneration which were in force prior to the 1931 financial crisis. At a conference between the employers and representatives of the men's unions, held in York, it was decided to restore the cuts, and the new rates will become operative from the beginning of November. Piece-workers will have an increase of 2s. 6d. per week, time-workers 1s. 6d., and labourers 1s.

THE DETROIT ELECTRIC FURNACE COMPANY, Detroit, U.S.A., makers of electric furnaces, has arranged with Battelle Memorial Institute, Columbus, Ohio, for an investigation of furnace construction and operation. The work at Battelle will be in charge of Mr. Harry B. Kinnear, metallurgist, and Mr. Chester R. Austin, refractories engineer. The programme includes construction and operating features, and is expected to solve some metallurgical problems arising from the various applications of electric furnaces in ferrous and non-ferrous fields, especially in customers' problems.

Structure of Ferro-Silicon

H. DELOMÉNIE ("Chimie et Industrie") has studied the structure of pure and commercial ferro-silicons containing 45 to 65 per cent. Si. Alloys containing less than 51 per cent. Si were found hard and resistant, with from 51 to 55 per cent. Si crystalline and above 55 per cent. Si of a grey colour. All were attacked by hydrochloric acid, hydrofluoric acid and alcoholic KOH. Pure alloys contained the FeSi more finely dispersed than the commercial samples, according to metallographic examination. Alloys with 50 to 54 per cent. Si were a eutectic of FeSi and $FeSi_2$ and were not subject to spontaneous ignition owing to the absence of arsenic and phosphorus. Above 54 per cent. Si. crystals of this element were found. Commercial ferro-silicon decomposed in moist air owing to the presence of an Al-P compound, and this did not occur except when both elements were present.



PROFITABLE
WEIGHT REDUCTION

Inspection doors, gear covers, guards and other large castings which call for periodic man-handling, are commonly lightened by production in aluminium alloy. The light metal (particularly the modified aluminium-silicon alloy) makes amply strong castings in thin section, with economy for this reason as well as in machining charges.

The illustration shows a 1,700 B.H.P. heavy oil engine by Fraser & Chalmers Engineering Works, Erith, in the power station of the West Cambrian Power Co., Ltd. Aluminium Alloy has been used for the inspection doors and pistons which are manufactured by Messrs. William Mills Ltd., Birmingham.

BA **ALUMINIUM AND LIGHT ALLOYS**
The BRITISH ALUMINIUM CO. *Ltd.*

HEAD OFFICE: ADELAIDE HOUSE, KING WILLIAM ST., LONDON, E.C.4.
TELEPHONE MANSION HOUSE 5561 & 8074 (5 LINES) TELEGRAMS: CRYOLITE, BILGATE, LONDON

LONDON WAREHOUSE: 25-29, Pancras Road, N.W.1
BIRMINGHAM: 2, Lawley Street.
MANCHESTER: 274, Deansgate.
LEEDS: 66, Kirkstall Road.
NEWCASTLE-ON-TYNE: Milburn House.
GLASGOW: 113, West Regent Street.

BARROW IRON

WEST COAST HÆMATITE
REFINED CUPOLA
OPEN HEARTH REFINED

Also **SEMI-PHOSPHORIC**
for Motor Cylinders, Valve Bodies, Steam and Hydraulic Castings, Etc.

LONDON OFFICE:
59, VICTORIA ST., S.W.1.

THE BARROW HÆMATITE STEEL CO., LTD., BARROW-IN-FURNESS, LANCS.

RAW MATERIALS—PRICE LIST

(Wednesday, August 22, 1934)

COPPER

	£	s.	d.
Standard cash	27	18	9
Three months	28	5	0
Electrolytic	31	0	0
Tough	29	15	0
Best selected	30	5	0
Sheets	58	0	0
India	40	15	0
Wire bars	31	10	0
Ingot bars	31	10	0
H.C. wire rods	34	0	0
Off. av. cash, July	29	15	0
Do., 3 mths., July	30	2	$1\frac{19}{11}$
Do., Sttlmnt., July	29	15	0
Do., Electro, July	33	0	0
Do., B.S., July	32	13	$0\frac{2}{3}$
Do., wire bars, July	33	4	$5\frac{2}{11}$
Solid drawn tubes			$9\frac{1}{2}$d.
Brazed tubes			$9\frac{1}{2}$d.
Wire			$6\frac{1}{4}$d.

BRASS

Solid drawn tubes	$8\frac{3}{4}$d.
Brazed tubes	$10\frac{1}{2}$d.
Rods, drawn	$8\frac{1}{2}$d.
Rods, extd. or rlld.	$4\frac{1}{4}$d.
Sheets to 10 w.g.	7d.
Wire	$7\frac{1}{2}$d.
Rolled metal	$6\frac{1}{2}$d.
Yellow metal rods	$4\frac{1}{2}$d.
Do. 4 × 4 Squares	$5\frac{3}{4}$d.
Do. 4 × 3 Sheets	$5\frac{3}{4}$d.

TIN

	£	s.	d.
Standard cash	226	5	0
Three months	226	5	0
English	226	10	0
Bars	228	2	6
Straits	226	12	6
Australian (nom.)			—
Eastern	228	12	6
Banca	227	5	0
Off. av. cash, July	230	9	$3\frac{9}{11}$
Do., 3 mths., July	230	1	$5\frac{8}{11}$
Do., Sttlmt., July	230	8	$10\frac{4}{11}$

SPELTER

	£	s.	d.
Ordinary	13	15	0
Remelted	14	10	0
Hard	11	10	0
Electro 99.9	16	5	0
English	14	7	6
India	13	10	0
Zinc dust	17	0	0
Zinc ashes	3	0	0
Off. aver., July	13	11	$7\frac{1}{11}$
Aver. spot, July	13	9	$3\frac{9}{11}$

LEAD

	£	s.	d.
Soft foreign ppt.	10	15	0
Empire (nom.)	11	8	9
English	12	15	0
Off. average, July	10	18	$6\frac{24}{32}$
Average spot, July	10	16	3

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	5	0
Do., V.M. ex whse.	21	12	6
Rods	27	10	0

ANTIMONY

	£	s.	d.		£	s.	d.
English	43	0	0	to 45	0	0	
Chinese, ex-whse.					36	10	0
Crude						—	

QUICKSILVER

	£	s.	d.		£	s.	d.
Quicksilver	11	2	6	to 11	10	0	

FERRO-ALLOYS AND STEEL-MAKING METALS

	£	s.	d.
Ferro-silicon—			
25%	8	17	6
45/50%	13	0	0
75%	18	7	6
Ferro-vanadium—			
35/50%	12/8 lb. Va.		
Ferro-molybdenum—			
70/75% carbon-free	5/6 lb. Mo.		
Ferro-titanium—			
23/25% carbon-free	9d. lb.		
Ferro-phosphorus, 20/25%	£16	0	0
Ferro-tungsten—			
80/85%	3/- lb.		
Tungsten metal powder—			
98/99%	3/3 lb.		
Ferro-chrome—			
2/4% car.	29	15	0
4/6% car.	23	0	0
6/8% car.	21	12	6
8/10% car.	21	12	6
Ferro-chrome—			
Max. 2% car.	35	10	0
Max. 1% car.	38	10	0
Max. 0.70% car.	41	5	0
70%, carbon-free	10d. lb.		
Nickel—99.5/100%	£200 to £205		
"F" nickel shot	£184	0	0
Ferro-cobalt, 98/99%	5/- lb.		
Metallic chromium—			
96/98%	2/5 lb.		
Ferro-manganese (net)—			
76/80% loose	£10 15 0 to £11 5 0		
76/80% packed	£11 15 0 to £12 5 0		
76/80% export	(nom.) £9 5 0		
Metallic manganese—			
94/96% carbon-free	1/2 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under $\frac{1}{4}$ in. to $\frac{1}{2}$ in.	3d. lb.
Do., under $\frac{1}{2}$ in. to $\frac{1}{16}$ in.	1/- lb.
Flats, $\frac{1}{8}$ in. × $\frac{1}{4}$ in. to under 1 in. × $\frac{3}{4}$ in.	3d. lb.
Do., under $\frac{1}{4}$ in. × $\frac{1}{4}$ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

South Wales—	£	s.	d.		£	s.	d.
Heavy steel	2	13	6	to 2	15	0	
Bundled shrngs.	2	7	6	to 2	8	0	
Mixed iron and steel	2	8	0	to 2	10	0	
Heavy cast iron	2	6	0	to 2	7	6	
Good machinery	2	10	0	to 2	12	6	
Cleveland—							
Heavy steel				2	10	0	
Steel turnings				1	17	6	
Cast-iron borings				1	7	6	
Heavy forge				2	10	0	
W.I. piling scrap				2	5	0	
Cast-iron scrap	2	10	0	to 2	12	6	
Midlands—							
Light cast-iron scrap				2	7	6	
Heavy wrought iron				2	17	6	
Steel turnings, f.o.r.				1	12	6	
Scotland—							
Heavy steel	2	10	0	to 2	11	3	
Ordinary cast iron				2	12	0	
Engineers' turnings				2	0	0	
Cast-iron borings				2	0	0	
Wrought-iron piling				2	11	3	
Heavy machinery	2	15	0	to 2	16	0	

London—Merchants' buying prices, delivered yard.

	£	s.	d.		£	s.	d.
Copper (clean)				25	0	0	
Brass				17	10	0	
Lead (less usual draft)				9	10	0	
Tea lead				7	0	0	
Zinc				9	0	0	
New aluminium cuttings				69	0	0	
Braziery copper				22	0	0	
Gunmetal				23	0	0	
Hollow pewter				145	0	0	
Shaped black pewter				110	0	0	

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	68/-
Hematite M/Nos.	67/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d/d	71/-
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
E.C. hematite	80/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	82/6
Clyde, No. 3	82/6
Monkland, No. 3	82/6
Summerlee, No. 3	82/6
Eglinton, No. 3	82/6
Gartsherrie, No. 3	82/6
Shotts, No. 3	82/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	9	12	6	to 9	15	0	
Nut and bolt iron	7	10	0	to 8	0	0	
Hoops	10	10	0	and up.			
Marked bars (Staffs) f.o.t.				12	0	0	
Gas strip	10	10	0	and up.			
Bolts and nuts, $\frac{3}{4}$ in. × 4 in.				14	0	0	
Steel—							
Plates, ship, etc.	8	15	0	to 8	17	6	
Boiler plts.	8	0	0	to 8	10	0	
Chequer plts.				10	7	6	
Angles				8	7	6	
Tees				9	7	6	
Joists				8	15	0	
Rounds and squares, 3 in. to 5$\frac{1}{2}$ in.				9	7	6	
Rounds under 3 in. to $\frac{1}{2}$ in. (Untested)				8	12	0	
Flats—8 in. wide and over				8	12	6	
,, under 8 in. and over 5 in.				8	17	6	
Rails, heavy	8	5	0	to 8	10	0	
Fishplates	12	5	0	to 12	10	0	
Hoops (Staffs)				9	7	0	
Black sheets, 24g. (4-t. lots)				10	10	0	
Galv. cor. shts. (,,)				13	0	0	
Galv. flat shts. (,,)				13	10	0	
Galv. fencing wire, 8g. plain				14	10	0	
Billets, soft				5	10	0	
Billets, hard	6	17	6	to 7	2	6	
Sheet bars	5	0	0	to 5	7	6	
Tin bars	5	2	6	to 5	7	6	

PHOSPHOR BRONZE

	Per lb. basis
Strip	9d.
Sheet to 10 w.g.	10d.
Wire	$11\frac{1}{2}$d.
Rods	10d.
Tubes	13d.
Castings	11d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Bessemer	20.76
Malleable, Valley	18.50
Grey forge, Valley	18.25
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	20/-
Durham foundry	21/- to 25/-
,, furnace	17/6
Midlands, foundry	—
,, furnace	—

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes 20×14 per box	18/-
,, 28×20 ,,	36/-
,, 20×10 ,,	26/-
,, 18¾×14 ,,	18/7½
C.W. 20×14 ,,	15/9
,, 28×20 ,,	33/3
,, 20×10 ,,	22/6
,, 18¾×14 ,,	15/9

SWEDISH CHARCOAL IRON & STEEL

	£	s.	d.		£	s.	d.
Pig-iron	£6	0	0	to	£7	0	0
Bars-hammered, basis	£16	0	0	to	£16	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to	£16	0	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£30	0	0	to	£31	0	0
Faggot steel	£18	0	0	to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0	to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£	s.	d.		
Aug.	16 ..	28	0	0	dec.	7/6
,,	17 ..	28	2	6	inc.	2/6
,,	20 ..	27	15	0	dec.	7/6
,,	21 ..	27	13	9	,,	1/3
,,	22 ..	27	18	9	inc.	5/-

Electrolytic Copper

		£	s.	d.		
Aug.	16 ..	31	10	0	No change	
,,	17 ..	31	5	0	dec.	5/-
,,	20 ..	31	2	6	,,	2/6
,,	21 ..	30	15	0	,,	7/6
,,	22 ..	31	0	0	inc.	5/-

Standard Tin (cash)

		£	s.	d.		
Aug.	16 ..	228	5	0	dec.	30/-
,,	17 ..	228	12	6	inc.	7/6
,,	20 ..	228	10	0	dec.	2/6
,,	21 ..	227	10	0	,,	20/-
,,	22 ..	226	5	0	,,	25/-

Tin (English ingots)

		£	s.	d.		
Aug.	16 ..	228	12	6	dec.	22/6
,,	17 ..	228	17	6	inc.	5/-
,,	20 ..	228	17	6	No change	
,,	21 ..	227	15	0	dec.	22/6
,,	22 ..	226	10	0	,,	25/-

Spelter (ordinary)

		£	s.	d.		
Aug.	16 ..	13	13	9	No change	
,,	17 ..	13	17	6	inc.	3/9
,,	20 ..	13	16	3	dec.	1/3
,,	21 ..	13	15	0	,,	1/3
,,	22 ..	13	15	0	No change	

Spelter (Electro, 99.9 per cent.)

		£	s.	d.		
Aug.	16 ..	16	3	9	dec.	1/3
,,	17 ..	16	7	6	inc.	3/9
,,	20 ..	16	7	6	No change	
,,	21 ..	16	5	0	dec.	2/6
,,	22 ..	16	5	0	No change	

Zinc Sheets (English)

		£	s.	d.		
Aug.	16 ..	23	5	0	No change	
,,	17 ..	23	5	0	,,	,,
,,	20 ..	23	5	0	,,	,,
,,	21 ..	23	5	0	,,	,,
,,	22 ..	23	5	0	,,	,,

Lead (English)

		£	s.	d.		
Aug.	16 ..	12	15	0	No change	
,,	17 ..	12	15	0	,,	,,
,,	20 ..	12	15	0	,,	,,
,,	21 ..	12	15	0	,,	,,
,,	22 ..	12	15	0	,,	,,

Imports and Exports of Pig-Iron, Iron and Steel Castings, etc., in July and the seven months, 1934, compared with a year ago.

	July.		Seven months.		July.		Seven months.	
	1933.	1934.	1933.	1934.	1933.	1934.	1933.	1934.
	Tons.	Tons.	Tons.	Tons.	£	£	£	£
Imports.								
Pig-iron, forge	—	—	—	—	—	—	—	—
,, foundry	2,828	2,925	20,768	17,896	12,309	8,461	73,024	51,133
,, acid	—	—	37	—	—	—	226	—
,, basic	4,685	5,859	28,502	40,018	12,623	16,850	76,262	109,082
Total (including other kinds)	7,513	10,908	49,307	66,954	24,932	36,034	149,512	211,558
Castings and forgings	66	398	637	2,388	1,095	9,999	14,229	60,019
Cast pipes and fittings	111	58	816	713	2,335	3,813	15,514	39,268
Stoves, grates, etc.	61	77	392	505	5,055	7,427	35,315	48,654
Baths	701	565	3,178	4,396	16,391	15,034	73,825	107,876
Hollow-ware, all kinds	249	156	1,282	1,440	8,858	10,235	53,140	80,652
Exports.								
Pig-iron, forge	67	65	1,097	654	288	277	4,328	2,725
,, foundry	6,223	6,458	27,134	41,092	20,520	21,708	93,974	140,721
,, acid	4,054	2,074	29,319	25,764	12,282	6,653	90,983	81,537
,, basic	10	30	890	808	40	113	3,493	2,636
Total	10,354	8,627	58,440	68,318	33,130	28,751	192,778	227,619
Castings and forgings	199	376	1,539	2,837	9,417	15,130	66,317	107,032
Cast pipes and fittings, up to 6 in. diameter	3,584	5,808	27,495	36,818	38,843	61,356	302,509	404,292
,, ,, ,, over 6 in. ,,	3,213	2,688	17,439	22,299	22,199	19,744	125,262	166,639
Stoves, grates, etc.	406	646	3,597	4,825	22,777	35,352	172,108	232,833
Sanitary cisterns	207	306	1,444	1,741	6,035	8,695	42,977	51,199
Bedsteads, inc. tubes therefor	282	353	2,266	2,994	10,144	11,896	84,238	98,860
Cast hollow-ware	292	324	2,300	2,016	11 927	12 090	93,214	78,690

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